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The Master Tools of Industry

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Early attempt of man to supplement his bodily efforts—The principle of the transfer of skill—Modern machines and the transfer of thought

IT IS an historical fact proven by all human experience that man has made progress toward his present civilized state only in proportion to his ability to develop tools of production wherewith to subdue his unfriendly environment and provide the comforts of life. We recognize this in a general way when we speak of the Age of Stone, the Age of Bronze, the Age of Iron and the Age of Steel. The full realization that this is true and that all physical, mental and moral development depend very greatly upon the industrial background has created a new and deep interest in industry and its relation to human progress. Man has never lacked for *ideals*, but these ideals have always been colored by his industrial background. The cannibal had no difficulty in justifying his practices. Plato accepted slavery as a necessity for a civilized state and Aristotle defended this practice as necessary and beneficial to the state. This has been true in all times and in all places and national ideals have risen and fallen as the difficulties of the industrial background have varied. In this modern age when we are committed to an effort to attain *universal well-being*, where all shall have enough to eat, enough to wear and a certain amount of mental and moral uplift, the industrial background looms large in our considerations, since the attainment of these modern ideals rests primarily upon our ability to create the necessities of life and distribute them equitably. No other civilization of which we have record has embarked upon such an undertaking.

The tools of industry may be divided in the interest of clearness into two classes. The first group may be called *labor saving machines*, and they represent man's efforts to supplement his own puny bodily efforts. Beginning with primitive efforts to harness the winds and waterfalls and domestic animals, this development has culminated in the gigantic water-driven power houses, steam-driven central stations and oil-burning engines.

But man also found long ago that with the use of tools he could greatly supplement his *skill*. Our savage ancestors found that it was easier to whittle out arrows with a bronze knife than with stone implements and in general as tools have been developed less skill of hand has been required of the worker. This principle, which is inherent in all tools, is known as "transfer of skill." It may in general be expressed as follows: Transfer of skill is accomplished whenever a tool or appliance is made by the aid of which operations formerly performed by a worker of a given degree of skill can be performed by one of a lesser degree of skill. A familiar example of such a transfer is seen in the application of a drilling jig where a skilled mechanic transfers his skill to the jig, making it possible for almost anyone to do the work as accurately and much more quickly than could the original skilled mechanic. Such tools are also often called "labor saving" tools, but this is not strictly accurate. They are more correctly classed as *"time-saving" tools*. Consider for instance a turret lathe. The operator, though a person of comparatively little manual skill, can, with the aid of the turret lathe, make accurately finished parts. But he may have to work harder operating this machine than the skilled mechanic who makes similar parts with a standard lathe. The output of this turret lathe, however, greatly exceeds that of the standard lathe. That is, the *time* per piece is reduced by the use of the turret lathe.

> IT IS interesting to speculate as to how far we shall or can go in making automatic machinery. The limit of the applications of transfer of skill and thought are still far away in most industries, and the future may see machines embodying these principles that will make modern machines appear as primitive to those then existing as the Hargreaves machine does to this generation of mechanics and designers.

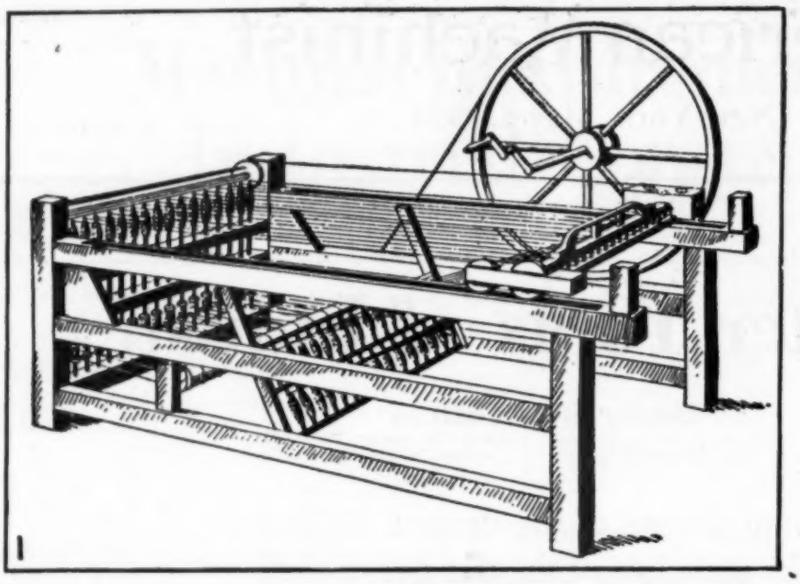
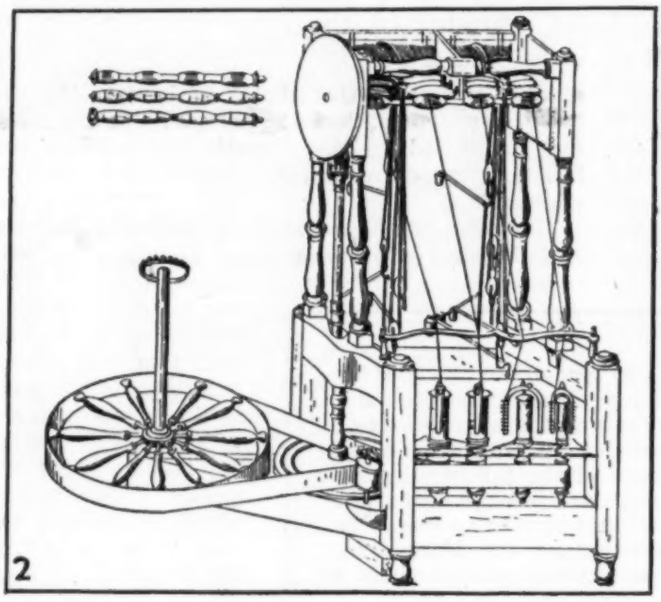
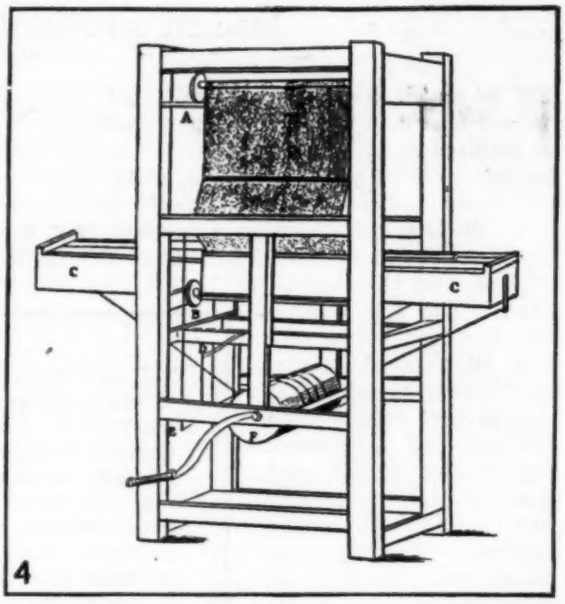


Fig. 1—The Hargreaves spinning jenny. The first semi-automatic machine

Fig. 2—The Arkwright "water-twist" machine. First introduced in America by Samuel Slater and put into operation at Pawtucket, R. I.





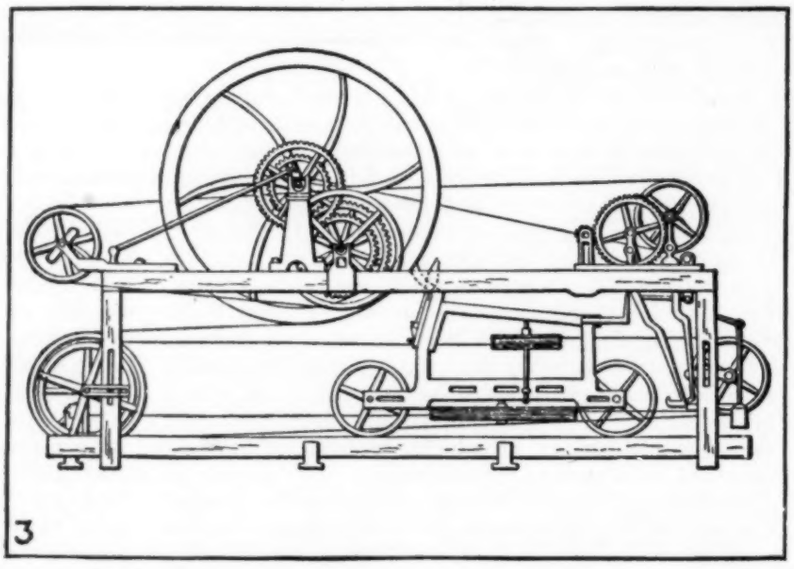


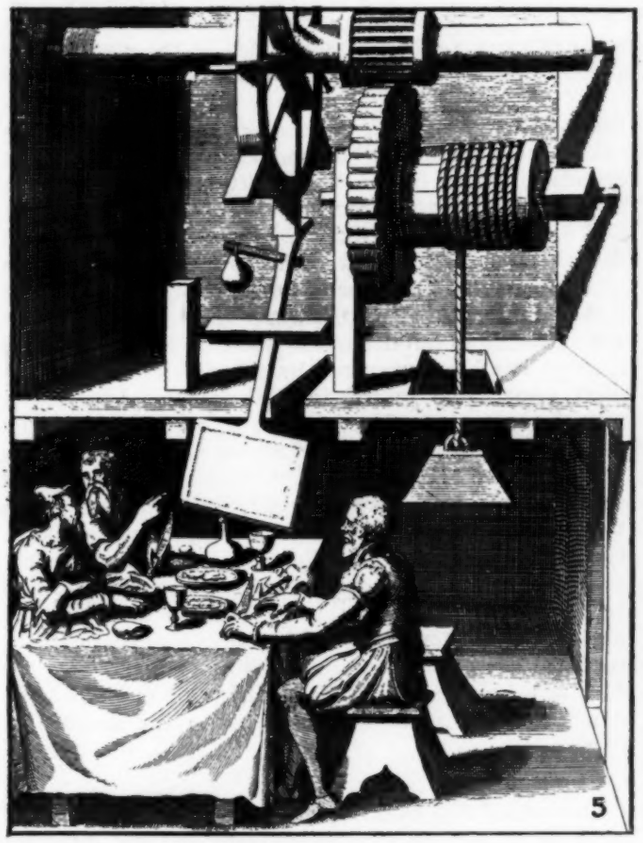
Fig. 3—The mule-jenny invented by Samuel Crompton

Fig. 4—The Cartwright power loom. It accomplished for weaving what Hargreaves' machine did for spinning

It should be noted that the principle discussed in the foregoing has nothing to do with division of labor, though it allows an extension of the same. Nor is the principle inherently applicable to machines alone; it can be and is applied to hand tools. It will be evident, furthermore, that for a given operation the more skill that is transferred to the machine or tool, the less is required in the operator. When nearly all the skill has been so transferred, but the machine still requires an attendant, it is called a *semi-automatic machine.*

Just as there may be a transfer of skill so there can be a *transfer of thought.* The skilled mechanic in drilling a hole in an exact location must exercise thought as well as skill. But the unskilled operator who may use a drilling fixture to perform the same operation is not required to put forth the same mental effort. Again an operator on a turret lathe must do some thinking in connection with his work, but in the full-automatic lathe the transfer of both skill and thought is complete and no worker is needed for the actual operation of the machine. This principle is recognized in some forms of automatic machinery in which the cam wheel which controls the movements of the several parts is sometimes known as the *brain wheel.* The modern player piano is an excellent example of transfer of skill and thought. The thought of the composer is transferred quite accurately but the transfer of skill in playing is more or less imperfect. It should be noted that composing and playing are not necessarily the accomplishment of the same man and the composer whose thoughts have been transferred may be long since passed away. Full automatic tools, as represented by the automatic screw machine, are the highest development of transfer of skill and thought beyond which it appears to be difficult to go.

Until the middle of the eighteenth century no tools had been invented that to any great extent lessened the degree of skill required on the part of the worker in any of the trades. The world had always been supported by handicraft and the tool had always been an adjunct to the skill of the worker. About that time, however, there began in England and on the Continent of Europe an era of invention that culminated near the end of the century in the development of certain spinning and weaving machines that for the first time embodied transfer of skill to such an extent as to make the worker an adjunct to the machine. This is the real essence of these so called "Great Inventions." The explanation most usually made that this development was an "introduction of machine industry" is not accurate. Machines of many kinds had long been known and some fairly complex mechanisms had been built many years before. The true explanation lies in the tremendous extension of the principle of transfer of skill which these new tools embodied.



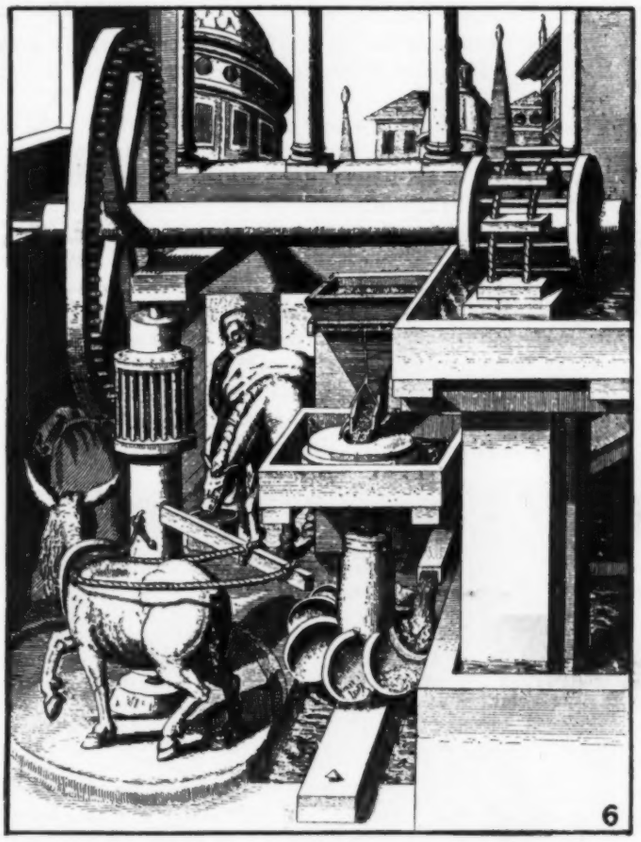


Fig. 5—A ventilating fan of 1624. A comparison between this and the modern electric fan is a fair measure of our scientific and mechanical progress. Fig. 6—A proposed grist-mill of 1624. Note the curious chain of mechanism for transmitting the power of the beast to the grinding stones

These machines were not complex as can be seen by the accompanying illustrations. Fig. 1 shows the first of these machines, the spinning-jenny invented by James Hargreaves, a weaver, in 1770. With this machine several threads could be spun simultaneously and *almost anyone could spin with it.* It was in fact the first semi-automatic machine. This was followed in

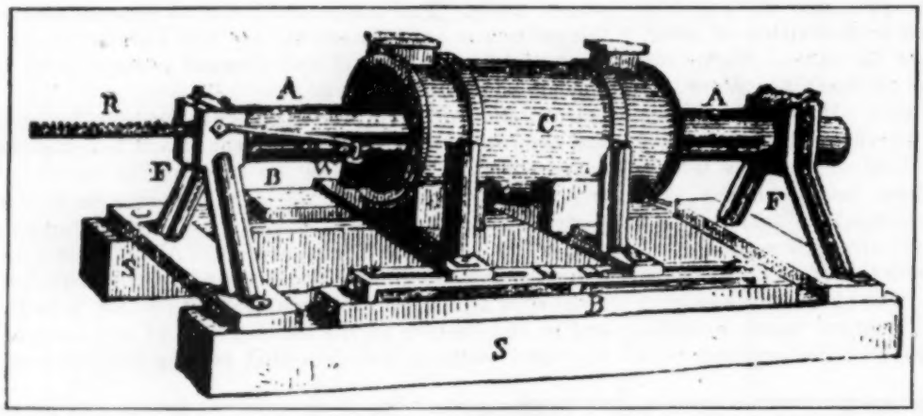


Fig. 7—Wilkinson's boring mill, one of the great improvements in machine tools. Many of Watts' cylinders were bored on such machines

1771 by the "water frame" of Richard Arkwright, a barber, Fig. 2, which introduced roller spinning and was driven by water-power and was the type of machine first introduced into this country by Samuel Slater. In 1779 a further improvement in the art of spinning was made by Samuel Crompton, a spinner, who invented the "Mule," Fig. 3. Finally in 1785 the invention of the power loom, Fig 4, by the Kentish parson, Dr. Edmund Cartwright, brought about the same improvement in weaving as had already been accomplished in spinning and a new era of manufacturing was launched. The effect of these so called great inventions is known as the Industrial Revolution. The invention of the steam engine in 1790 gave the new movement a tremendous impetus and by the end of the century the extension of these principles to other forms of machinery was well under way.

Fig. 8—The original one-man oriental lathe still in use in the far East

It is impossible for us in these days of powerful and highly developed machine tools to visualize the difficulties that the building of these new tools of industry brought to the mechanics of the latter part of the eighteenth century. Figs. 5 and 6 may give some idea of the state of the art of machine construction during the seventeenth century. When Watt invented the steam engine there was not in existence any tool or appliance for machining his cylinders. Watt in one of his letters tells of his first cylinders that varied from being truly circular by only half an inch. After Wilkinson invented the boring mill shown in Fig. 7 he bored cylinders for Watt that were true within "the thickness of an old shilling." Here was a need for new kinds of machines since hand work was not sufficient to build the new tools of industry. This demand has been answered by the development of the most remarkable set of tools that human hand and mind have ever produced. They are known generally as "machine tools," a rather meaningless term. They are really the "Master Tools of Industry," for without them modern machinery cannot be constructed. These tools are respectively the lathe, the planing machine, the drilling machine, the milling machine, and the grinding machine. There are, of course, many variations in the construction of these tools and a number of derivatives as, for example, the boring mill which is a modified lathe. The building of these master tools has become a great industry that stands in a class by itself and is one of highest importance to the welfare of humanity.

Early Forms of the Lathe

One would naturally expect to find a large degree of transfer of skill in the development of these machines and the development of the lathe, "the king of machines," illustrates the growth of this principle admirably. Figure 8 illustrates an oriental lathe or turning machine of very ancient origin. Such a lathe was in operation in an oriental exhibit at the Pan American Exposition a number of years ago. The piece to be turned is mounted upon two stationary points, or centers, these centers being either driven into the ground or held fast in a board. The operator rotated the work to and fro by means of a bow, held in one hand, the string of the bow being wrapped once around the piece to be turned. A cross bar for resting the turning tool, the progenitor of the "rest" in the modern wood-turning lathe, can be seen in the illustration. Cutting was done by the tool held in the workman's hand only while the piece rotated toward him. When the hand became tired the workman relieved the strain by guiding the tool with his great toe and the one next to it as shown in Fig. 9. The "lathe hand" who was operating the machine at the Buffalo fair was making chess men, small boxes and similar product which he sold on the ground

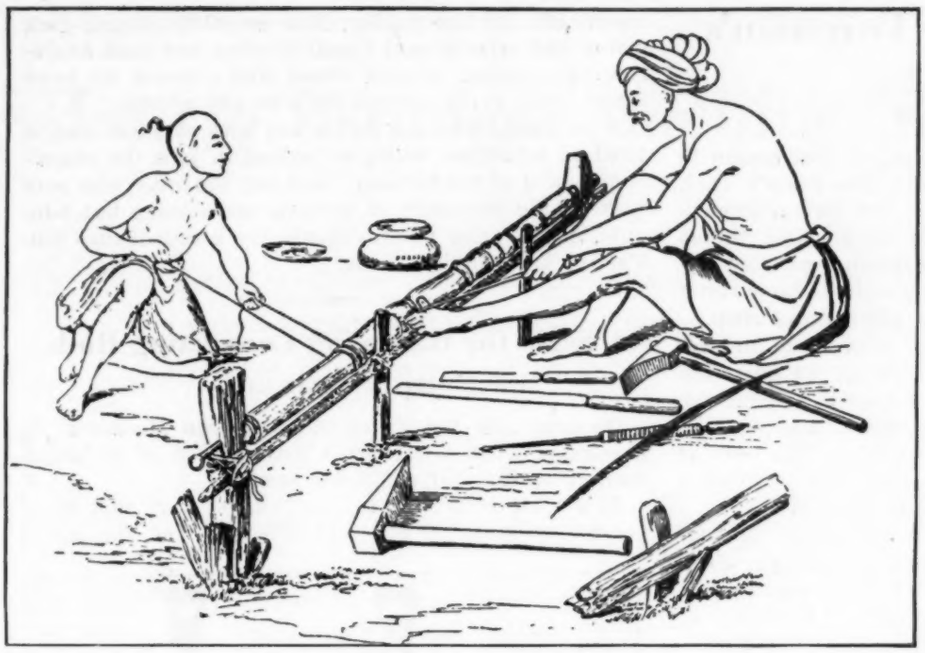


Fig. 9—The "two-man" oriental lathe

and his skill of hand and "skill of toe" was remarkable, while the rapidity of his operations was almost unbelievable.

This father of the lathe has come down to us, probably through the Moors, and by way of Spain, in a modified form. Figure 10 shows the modified form that adapted this implement to the habits of the occidental worker who *stands* rather than *sits* at his work, as does the oriental. This ancient machine is preserved in the South Kensington Museum in London. Similar machines were quite common in New England not so many years ago and the writer well remembers seeing one of them, still in operation, in his boyhood. In the illustration the original lathe is supported by a modern frame. Frequently such a lathe rested upon a bench and had no "legs" as shown in the illustration. The "headstock," "tailstock" and "rest" are clearly distinguishable. One end of the string which rotated the work to and fro is fastened to a spring pole attached to the ceiling, and the other end to a treadle. Both hands of the operator were free for the operation of turning and less skill was required of the workman.

(To be concluded)

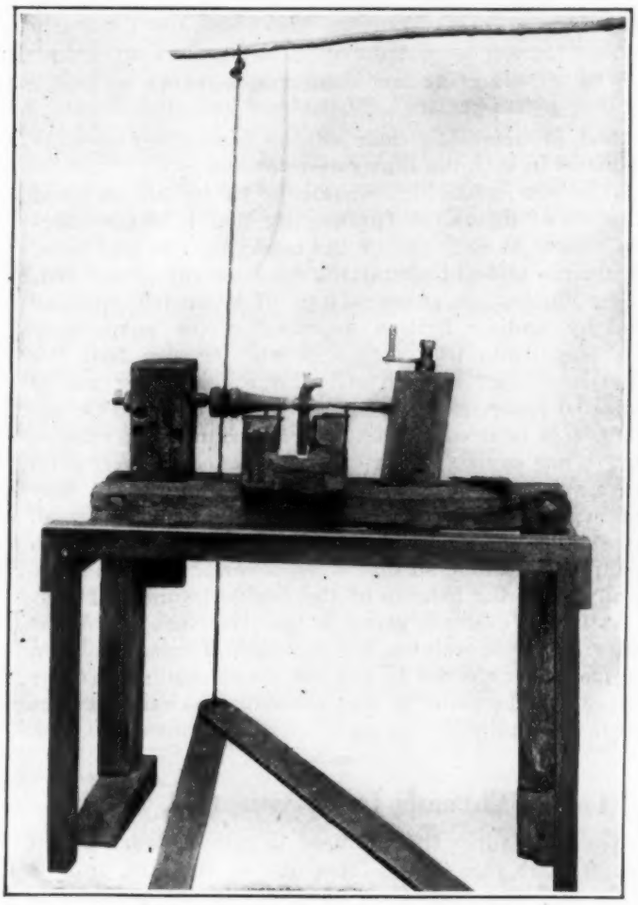


Fig. 10—An old "pole-lathe" preserved in the Kensington Museum, London

Saving Metal in Radio Punchings

CLIFFORD H. FRENCH

The making of variable condensers for radio work has developed into quite a business and the question of saving metal is important. The U. S. Tool Co., Newark, N. J., makes a large number of variable condensers and has designed and built punching dies that waste the minimum amount of aluminum.

Closely-spaced punches for condensers

The illustration shows the press, with its roller feed and the table or tray on which the latter rests. The sheet at the right shows the layout of the punchings and gives an idea both of the saving of metal and the close spacing of the punches and dies.

While the saving as indicated may appear to be a small matter, when the immense number of punchings required is considered, it amounts to a tidy sum.

The Round House Foreman's Job

By R. W. Hamer

THE roundhouse foreman is a sort of first cousin to the top-sergeant in the army. He doesn't rank very high when it comes to titles but he's a mighty important factor when it comes to keeping things moving. There's been many a captain promoted because his top-sergeant knew his job and the same thing can be applied, to some extent, to the railroad shop.

There are not only the monthly inspections and reports, but a multitude of other things to keep the roundhouse foreman from being lonesome. Here, for example, is an engineer's recent report, made at the end of a trip and called running repairs. The work is supposed to be done in time to have the locomotive ready when called for. Just gaze at the list!

"Close guides; tighten binder bolts; adjust brakes; wash out boiler; examine and repair air pumps; clean and adjust pump governor and feed valve; clean triple valve on engine and tank; clean automatic brake valve; stop leaks in feed pipe; renew glass in cab windows; put re-trackers on engine; stop steam leaks around relief valves; calk leaks in mud rings; calk leaks in fire box, flues, stay and crown bolts. Renew and connect up grates; renew steps on front of engine; renew nut on trailer-box bolt; stop leaks in air pipe at main reservoir; bore out flues; tighten crosshead pin; tighten knuckle-pin nuts; renew end sill on front end; renew tank brake-shoes where needed; repair false deck in tank; renew coil springs; renew spring hangers. Test air pump, not making enough air; clean water glass; straighten brake pipe under tank; connect drain pipe to drip pan; eccentric block loose on axle; renew latch on fire door; renew clamps on sand pipes; renew generator and cab lights; renew chafing casting between engine and tank; grind drain valve to water glass; clean and repair lubricator—not feeding; repair air bell-ringer and renew bell cord; repair rain and windshields; repair cylinder cocks; clean out oil cups to air pumps; repair air reverse lever."

The Joys of a Roundhouse Foreman

That little list gives some idea of the joys that beset a roundhouse foreman. Reminds me of a case of long ago, on a road where the power was in very bad shape. One old engineer reported as follows:

"Everything leaks but the sand box and that won't." While a second engineer wrote "Jack up the whistle and put a new engine under it."

All the repairs mentioned are small but take time and mean labor with very little assistance from machinery of any kind. In addition there are such heavy jobs as changing tires, dropping driving wheels to change driving box brasses, renewing superheater units and renewing truck wheels on engine, tank and trailer.

All kinds of electric and acetylene welding are done. One recent job was on a big Mallet engine that came in with all driving wheels flattened for about 4 in. The flat spots were filled in with the arc welder and then smoothed up with a portable air grinder, so that the engine was ready to go out on her run the next day.

Then you can add the monthly inspections, which usually include the following items: Renew rod bushings; file and line main rod brasses; line driving-box wedges; renew joints in steam chest covers; re-babbitt crossheads and line guides; close eccentric straps; pack piston and valve stems; repair driving and tank brake-rigging; tighten driving wheel tires; renew all loose frame keys; grind throttle dry pipe and whistle.

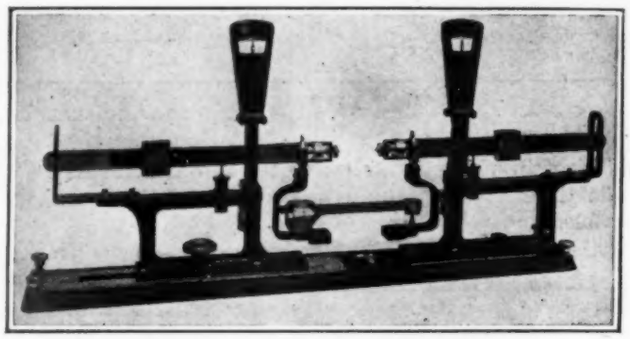
A mechanic who can tackle any sort of a job and is tired of repetition work, is invited to join the roundhouse gang of machinists. And any foreman who gets tired of the monotony of turning out nothing but ½-in. nuts, month after month, should try a roundhouse job. Variety is its middle name.

A Scale for Balancing Connecting Rods

By J. F. Ritchie

On page 120, Vol. 60 of the *American Machinist*, is illustrated what is termed a new method of weighing connecting rods for motor-car engines.

It is a bit surprising to find in these days that there are motor car firms who still adhere to the antiquated



Connecting rod balancing machine

method of balancing their engine connecting rods as instanced in both the illustrations shown.

It is now generally considered to be an accepted principle of motor car engineering that it is the effective weight at each end of the conecting rod that is of importance and not simply the dead weight of the rod.

The illustration shows a type of balancing machine used by leading British makers for the purpose of balancing connecting rods. It will be seen that the effective weight at each end of the connecting rod is indicated independently. By use of this machine the assembler is enabled to mate up his connecting rods so that in one engine all give the same effective weight on the crank pin, or, if carried to finer limits, the best practice to a standard connecting rod is adopted for all the engines made, and each connecting rod in its turn is adjusted to this, so that when a replacement is made at any time, the balance of the engine is undisturbed.

As in the example given in the *American Machinist* under and over weights are indicated automatically on the machine referred to and the finest readings are by 2 drams. The point is that simultaneous readings are shown automatically for each end of the connecting rod.

Taper Threads in Locomotive Work

Nearly all taper threads used in railway work are of the standard pipe-thread taper of ¾ in. in 12 in. or 1 in. in 16 in. The diameters, however, do not conform to standard pipe sizes and 12 threads to the inch is usual regardless of diameter. On the Santa Fe system threads of 6, 9, 10 and 11 per inch are used in some cases.

How to Estimate Machine Shop Costs

By Albert A. Dowd

Third article—Shop conditions which affect the cost estimate—Importance of co-operation between shop and estimating department—Factors controlled by nature of work

BEFORE taking up the various details of cost estimating a few of the factors which affect the matter of costs should first be considered, and their importance with respect to production work should be noted. Although the various items mentioned here do not affect the estimating department except in an indirect way, they do affect the cost of production and must therefore be considered. Work in the factory can be accomplished in a satisfactory manner only by painstaking workmen, well kept machine tools, properly designed jigs, fixtures and gages, and careful supervision. The importance of the item last named should be fully realized by an executive if he wishes to obtain the greatest possible efficiency.

The speeds and feeds used in the shop should be set by the production engineer in accordance with the data furnished by the estimating department and, after the correct feeds and speeds have once been determined, they should not be changed without a written order. The piecework prices are based on the estimated production time, and if this is not maintained a loss will certainly be sustained by the plant. The estimating department should always be conservative in making time studies so that the manufacturing departments can keep within the time specified without extraordinary effort.

Suggestions From Shop Men Valuable

It is often desirable, when estimating work of a somewhat complicated nature, to call various shop foremen into conference in order to take advantage of their experience on work of a similar nature. Valuable suggestions are often obtained at such conferences through the practical experience of the foremen and their knowledge of the machining possibilities of certain kinds of materials at given speeds and feeds, particularly when the materials are somewhat unusual. Also, the estimator may have selected a certain machine tool for a needed operation, and his choice may meet with opposition from the shop foreman, on account of some peculiarity in the construction or operation of the machine. Although the selection has been made in accordance with the requirements of the work and in conformity with the machine data sheets, and the machine should, from all information at hand, be perfectly suitable for the work, yet the shop foreman may happen to know that the particular machine needs a general overhauling, or that some portion of it is so badly worn that it cannot be depended upon for accurate work. Such points are often brought out at a conference and subsequent confusion or the changing of manufacturing methods may be minimized in this way.

It is a decided advantage to the estimating department if the shop will co-operate in such a way that, when a machine tool is withdrawn from production work or replaced by one of more modern construction, a written notice containing details of the change will be sent to the estimator-in-chief. It is very little trouble for the factory to do this and the practice enables the estimating department to keep its records up-to-date. Information on new machine tools can be obtained before the machine is actually installed in the shop and the use of the new tools can be considered for any new work upon which estimates are made. It is best to remove the data sheets for any obsolete machines and place them in a separate file, in order to avoid cumbersome records.

Payment Methods Affect Estimate

In estimating costs for any given work, the estimating department is affected to some extent by the method of payment to the workmen. If day work is the method employed, the workman receives a certain amount per hour or per day and the number of pieces of work which he turns out, depends upon his ability. Hence, the estimating department must make due allowance in order to provide for contingencies. A man who is paid by the hour has nothing to gain, except the commendation of his foreman, by working exceptionally hard and turning out an extraordinary day's work. When work is done on a piecework basis, however, the man receives a stipulated sum for each piece turned out.

The majority of shops engaged on production work use a piecework system of some sort, since they can be sure of their production costs only by basing their prices on the time estimate prepared by the estimating department. The premium and bonus systems are slightly different from the piecework basis of payment, but the idea in each case is to establish costs for all work and avoid "soldiering" on the part of the operators.

Theoretically, the actual profit on the work should correspond very closely to that figured in the estimate, providing that everything works smoothly and that piecework rates are based on estimated time. In reality, however, it is rather unsafe to set piecework rates exactly at the cost indicated by the time estimate of the labor involved, because of manufacturing contingencies which cannot always be foreseen. The estimator must consider these matters carefully when

This is the third article. The second article was concluded on page 611, Vol. 60, No. 17.

making time studies and err, if at all, on the side of conservatism, in order to allow for unforeseen troubles which actually occur in the process of manufacturing.

The decision as to whether the inspector's time should be included in the estimate depends a great deal upon the method of inspection used. If it is carried as burden, it should be included in the overhead charges; if not, it should be added to the estimate as a separate item, with perhaps a different rate per hour than the production work. Inspection time is seldom considered in making estimates of costs and it does not appear necessary to discuss the matter here.

When castings are to be machined, a preliminary inspection of the rough castings may often save a great deal of trouble which might otherwise be caused by partially machining defective castings. The layout of operations should always take this point into consideraion and, when very irregular castings or those of a fragile nature are involved, it may be necessary to provide special fixtures to assist the inspector.

In general it may be stated that the available equipment in the factory and the human element, as represented by the class of labor employed, are the two most important preliminary factors which must be considered when estimating. The factory arrangement and the method of lighting, heating, and ventilating have an important effect on the production, but do not necessarily effect the estimating department. The method of applying power to machine tools actually effects the time of production in some cases, particularly when individual motor drive is compared with group drive, but even then it is not very noticeable, except when a number of different speeds are used on a single piece of work. In this event, there may be slight savings which would affect the time studies made by the estimating department.

Tools Selected to Suit the Work

In the older plants there are often a number of more or less obsolete machines, while in newer factories the installations will naturally consist of more modern machine tools. The estimating department may frequently be compelled to plan production on both modern and old style machines and, when cases of this sort arise, the less important work should be placed on the older machines. In addition to the points mentioned, the estimating department of any factory must be thoroughly familiar with the arrangement and equipment of the various departments, to insure the work being placed where it can be handled to the best advantage.

Many factors in an estimate of cost are governed by the nature of the work itself, and other matters intimately associated therewith. A number of these important points will be given here and commented upon in a general way, more detailed consideration being given each of the subjects in subsequent articles.

1—*Nature of the work.* Production work covers a wide field and there are so many conditions which may be encountered that it seems necessary to mention them here as briefly as possible. An estimate may be required for the machining of a single piece of work in a lot of 5,000 pieces and the piece may be so simple that it needs only one operation on a screw machine or perhaps a single milling or drilling operation. Again, the work may be such that it requires a number of operations of different kinds even when only a single part is being considered. The material of which the work is composed may be bar stock, casting, forging, or steel stamping or it may be brass, bronze, aluminum or alloy steel.

A simple case, for example, is the piece shown at *A* in Fig. 7, which is to be produced in a lot of 10,000 pieces from bar stock, and it would naturally be made on an automatic screw machine, complete in one operation. Another example, shown at *B*, is a small cast-iron bracket wanted in a lot of 500 pieces, and having three holes drilled in it. Only one operation is required on

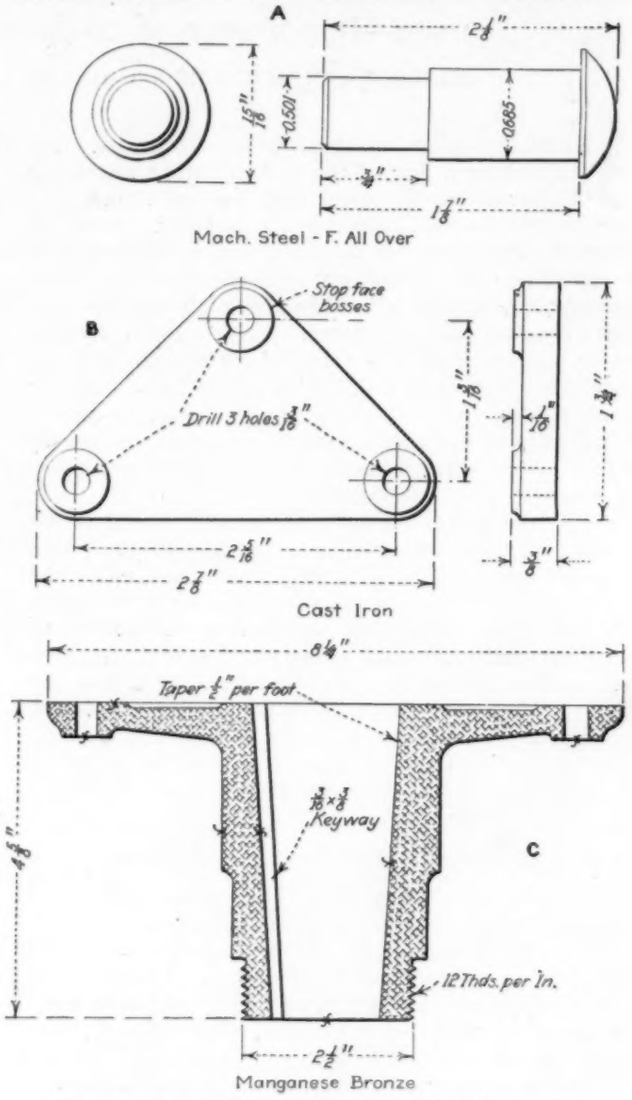


Fig. 7—Several examples of production work

this piece and that is the simple one of drilling the three holes. The part shown at *C* is a bronze casting having a flange in which there are six holes equidistant from the center, and having a tapered hole with a keyway cut through the hub. This piece is faced on the flanged end and is also finished and threaded on the other end. Four operations are required to complete it.

These three examples are given to illustrate the great variation found, even in single pieces on which a production estimate is required. In a completed mechanism we have still more variations to consider, for there are a number of parts which go to make up the complete unit. For example, consider the various parts which

go to make up a transmission gear case for an automobile; a complete rear axle containing differential gears, pinions, etc.; a headstock for an engine lathe complete with back gears; a centrifugal pump or a gear pump, and many other more or less complete mechanisms. In all of these not only the manufacture of the parts must be considered, but also the assembling of the various units, together with the testing and final inspection.

Production and Unit Estimating Similar

It must be remembered that we are considering production or quantity work at present and, although this division of the subject of estimating is much larger and covers a greater variety than any of the others, there are many points which apply equally well to the estimating of other kinds of work. In estimating the costs of manufacturing an entire automobile, a machine tool, an electric motor, a locomotive, a marine engine, or many other well-known mechanical devices, the same principles are applied with the addition of a few other details.

2—*Quantity required.* The number of pieces or units required is an important factor in estimating costs, particularly when a number of special tools are required and when the machining operations are somewhat complicated. There are two ways in which cost estimates are made, one of these being an estimate of the actual cost of production as a single item with a separate quotation included to cover the cost of special tools, gages, etc. In the other method the price of the complete job is quoted and includes the extra amounts required for all special tools necessary on the work. The first of these methods is generally used when the tools are to be turned over to the customer at the completion of the work, the second method being more generally employed when the tools are retained by the manufacturer in expectation of future orders. These matters must be settled at the time the estimate is made. The cost of a quantity of any given unit is affected by the setting-up time of the machines used and the unit cost for each piece grows less as the quantity increases.

3—*Patterns needed.* In many cases the estimating department is required to consider not only the machining of various units, but also the making of patterns for the units, and any jigs and fixtures which may be necessary. In the estimating of pattern costs a great deal depends upon the number of units required, the nature of the work, the kind of material and the purpose for which the castings are to be used. When large quantities are required several patterns may be needed and, in some cases, it may be economical to use metal patterns.

4—*Drop forging dies.* It is not usually necessary to include in an estimate of production the cost of drop forging dies which may be required in making the forgings but, in the event that forgings are not furnished by the customer, the estimate must include a sufficient amount to cover the cost of the dies and their upkeep, when very large quantities are required. If the factory has a drop forge department of its own, the matter is very easily determined. Otherwise the die work can be submitted to several outside firms, preferably those which are prepared to furnish both dies and forgings.

5—*Machine tools required.* The selection of machine tools for any given piece of work requires a broad knowledge of the best methods of manufacture, and discriminating judgment regarding the best machines for the various operations. The estimating department, in addition to data sheets of all the machine tools in the factory, should also keep on file the latest information regarding new machinery and up-to-date methods of manufacture.

6—*Machine tools available.* It is not always possible to obtain exactly the machine wanted for a certain operation and, when a considerable quantity of work is to be manufactured, the estimating department should determine roughly what operations are necessary and whether the machines available can be adapted to suit certain cases or not. New machinery cannot always be obtained when needed and it may, therefore, be necessary to utilize those which are available in a somewhat different way than that for which they are intended, and to use special attachments or tooling to obtain the results desired. The ingenuity of the estimator is sometimes severely taxed when conditions of this sort arise, but it is usually possible to solve such problems by means of a conference of executives.

7—*Jigs and fixtures.* Occasionally work is taken in on a production basis when the tools have already been built and the parts manufactured by some other firm. Under these conditions, the estimating department is somewhat handicapped, unless a complete list of operations and drawings of the jigs and fixtures are furnished. In many instances the list of operations, showing how the pieces have been handled by some other manufacturer, may not conform to the ideas of the estimating department, and the tools may not all be suited to the machines available. Considerable research work is necessary to determine these matters, and it may be found that adapter plates, angles or other units are required in order to use the tools furnished. The importance of looking into the matter of jigs, fixtures and gages at the time the estimate is made, cannot be overestimated.

Importance of Gage Requirements

The kind of gages required and the limits of accuracy determined by the customer also have an important effect on the estimate. The quantity to be manufactured naturally controls the number of gages needed, but the types employed depend upon the accuracy required. Simple gages may fulfill the requirements of a small job very well, but it is always advisable to remember that a poor gaging system is likely to cause extra expense in the final fitting and assembling of the units. When gages are furnished by the customer for whom the work is being done, it seldom happens that they are complete enough for use on production work. A few may be suitable but, in all probability, others will be necessary for certain dimensions.

8—*Accuracy required.* Not only must the matter of gages be carefully considered when making estimates for production work, but also the method of machining parts in order to hold them within the required limits of accuracy. If a certain piece of work is to be held to very close limits, a single cut over the surface will not be sufficient, and both roughing and finishing cuts will be needed. For unimportant dimensions, a single cut may be all that is necessary, unless accuracy is required in order to fit a jig or fixture used subsequently. There are occcasional cases, however, when

savings may be effected by finishing surfaces or holes to accurate sizes, even if they are not called for on the drawing. Examples of this sort will be given later.

9—*Set-up costs.* The cost of setting up machines for production work is controlled to some extent by the factory equipment. When production is very high and factory equipment not quite sufficient to handle it without using the same machines for different operations on several pieces of work, a setting may be broken up a number of times during the progress of the work. Delays in receipt of working materials in sufficient quantities also cause set-up losses and the estimating department should find out in what quantities the rough parts may be expected. The time of delivery specified for the work may also be a factor in determining how long a machine tool can be used for a given operation, and in all cases the time for setting up and dismantling the machine must be included in the estimate with a sufficient allowance to cover contingencies.

10—*Assembling costs.* The accuracy with which the work has been done effects the cost of assembling to a great extent. Unless great care is used in the manufacture, the final fitting and assembling of the parts may easily absorb all the time saved by the use of good tooling equipment. In high production, assembling fixtures of various kinds are often a great advantage, but they are frequently not included in the estimate due to a lack of foresight or carelessness in the estimating department. A well made estimate considers the various units to be manufactured, their final fitting and the most economical method for assembling. In other words, the estimating department should plan all the operations and carry the work through until it is ready to ship.

11—*Testing.* Assembling and testing of complete mechanisms are often done in the same department, and sometimes by the same workmen. Occasionally the testing may require considerable labor, particularly when the mechanism is of a complicated nature, and this must be considered in the estimate. A special type of clutch, for example, may be required to transmit a certain number of horsepower, in which case it must be given a brake test. So also a pump may be required to deliver a certain quantity of liquid per minute, and it must be tested to see whether it fulfills the requirements or not. Many other examples could be given to illustrate the importance of the final testing of different mechanisms.

12—*Delivery dates.* Many kinds of work are produced under so called "penalty contracts" the object of which is to make sure that the work will be completed at a given time. If this time is exceeded a penalty of a certain specified amount per day is deducted from the purchase price and the manufacturer has to suffer for it. Usually, however, there is a corresponding "bonus" which is received by the manufacturer if the work is completed ahead of time. Whether an estimate is made under these conditions or not, the greatest care should be used by the estimating department in specifying delivery dates. The estimate should always read "delivery ———— weeks after receipt of formal order." The time allowances for production should be very carefully estimated with a sufficient amount of latitude to take care of manufacturing contingencies, delayed castings or forgings, or any other matters which may be likely to prevent the work from being put through without delay.

Making a Metal Wing-Float

By Chester H. Franklin

Building up a float from sheet metal so as to have all the joints water tight, isn't as easy a job as might be imagined, especially as solder is not to be considered in

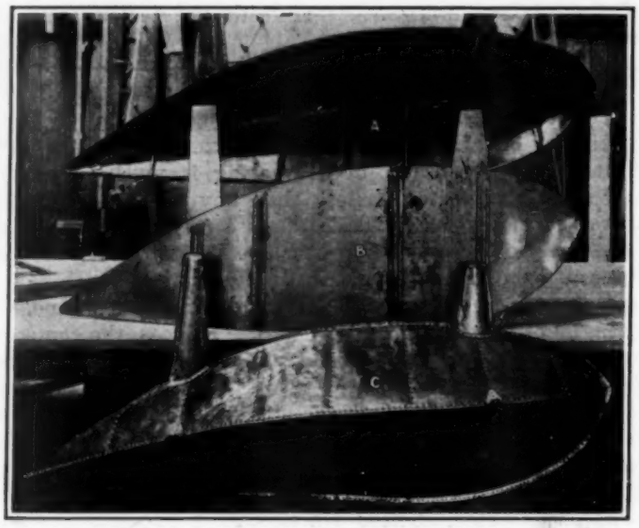


Fig. 1—How the Float Is Made Up

the case of duralumin. The float shown in Fig. 1 was made by the Aeromarine Plane and Motor Co., Keyport, N. J., for one of its flying boats. It must not only be water tight, but must be capable of standing considerable shock, both from landing and from wave action.

As can be seen in Fig 1, the float consists of three parts, the two sides *A* and *C*, and the center or stiffening plate *B*. The sides have seven stiffening ribs to which the two sheets are riveted. They also have oval projections by which the floats are fastened to the

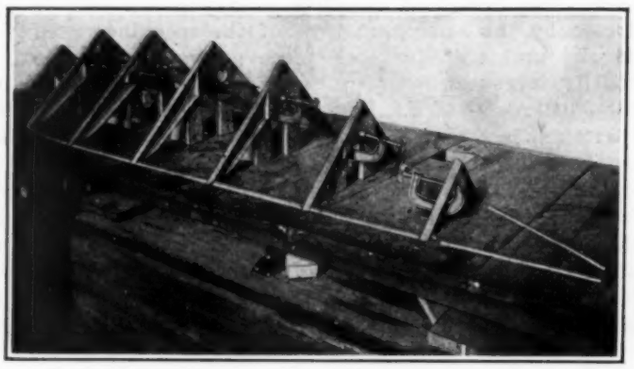
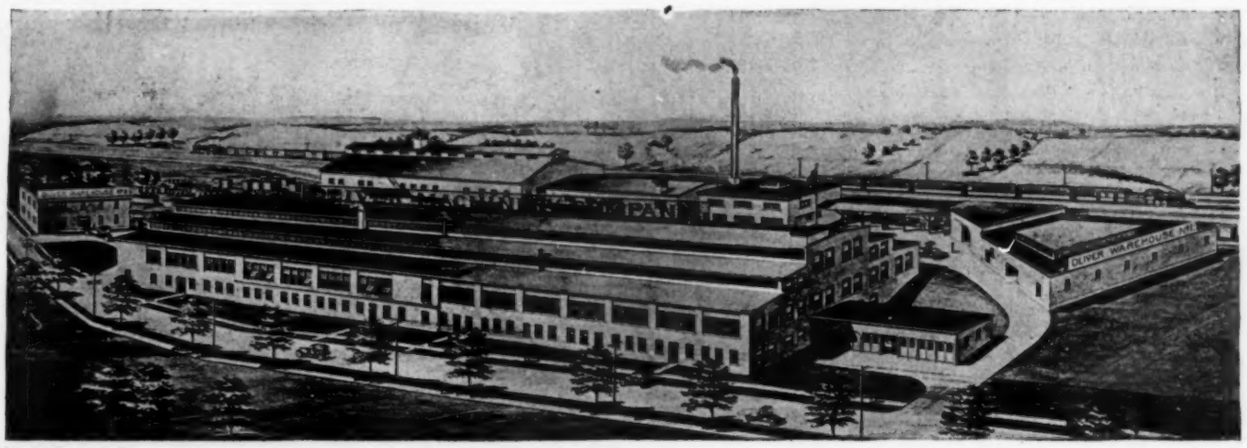


Fig. 2—Holding the Ribs for Riveting

wings of the plane. The central plate carries a stiffening web for each of these projections.

The method of building the sides is shown in Fig. 2. The ribs are clamped to uprights located at suitable points, which hold them square while the side sheets are riveted in place.

In assembling the parts to make up the complete float, a strip of tarred felt is placed between each joint and riveted in place between the metal surfaces to make a water tight joint. The edges are flanged to make it easier for both the riveting and the holding of the tarred strips.

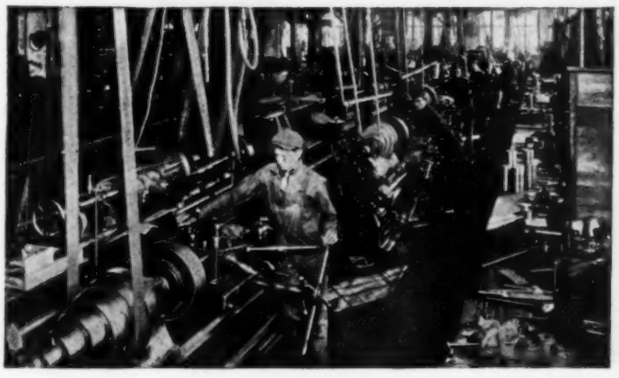


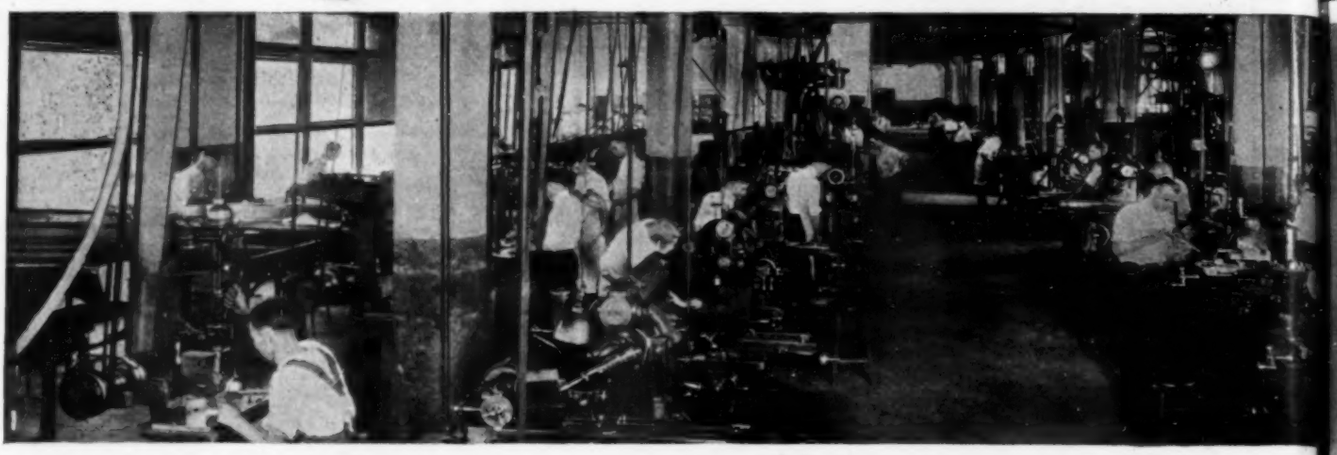
Where Machine Tools Are Made

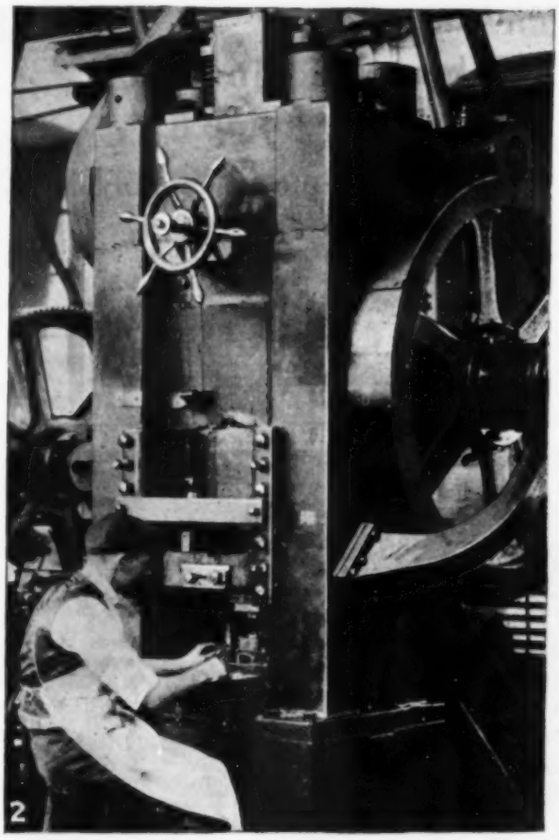
Oliver Machinery Company
Grand Rapids, Mich.

Original company (American Machinery Co.) founded 1890

Exterior of main plant, one of the jig rooms, main bay of main plant, engine lathe and grinder departments







Steel+Tools+Brains =Adding Machines

Dalton Adding Machine Company
Cincinnati, Ohio (Norwood)

Fig. 1—The tool room

Fig. 2—A swaging operation

Fig. 3—A view in the punch press department

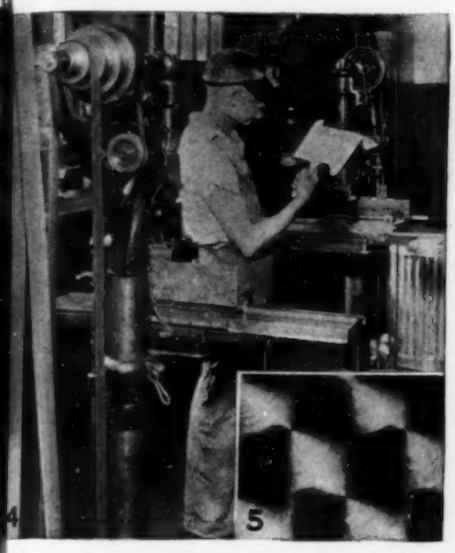
Fig. 4—Machines on which the Damaskeen finish is produced

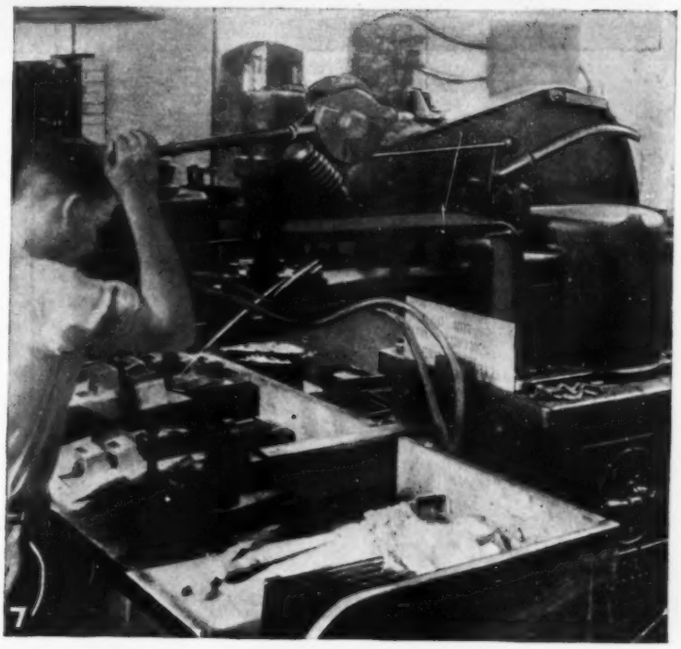
Fig. 5—Example of Damaskeen finish

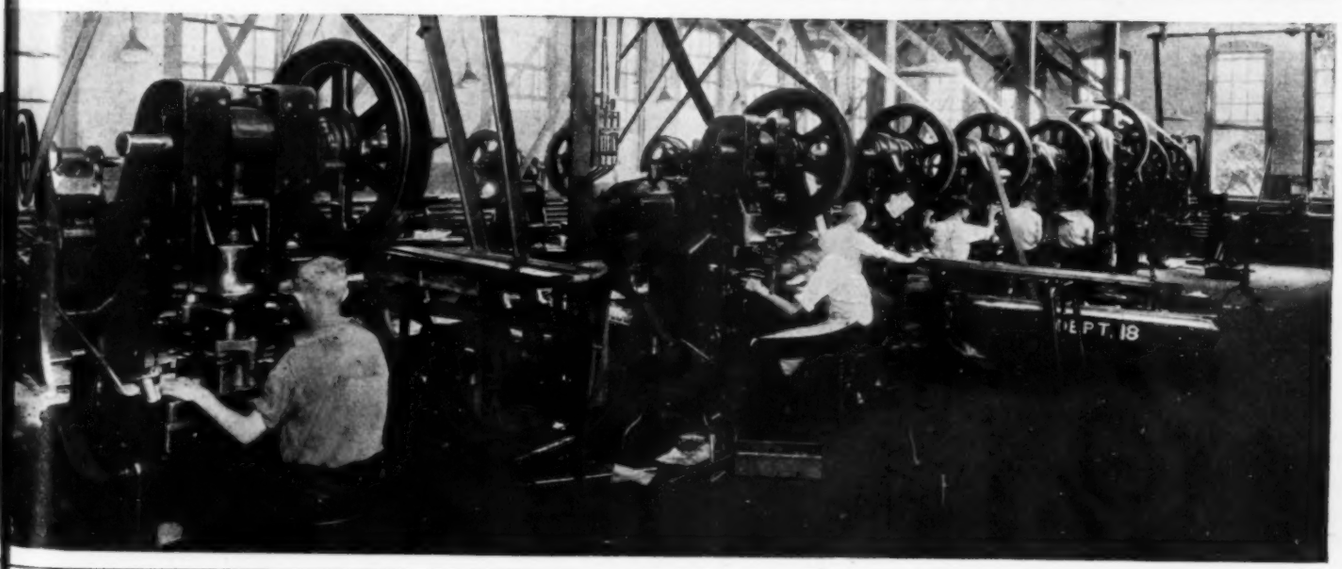
Fig. 6—The type-making department

Fig. 7—One of the machines in the spot-welding department

Fig. 8—Another view of the punch press department



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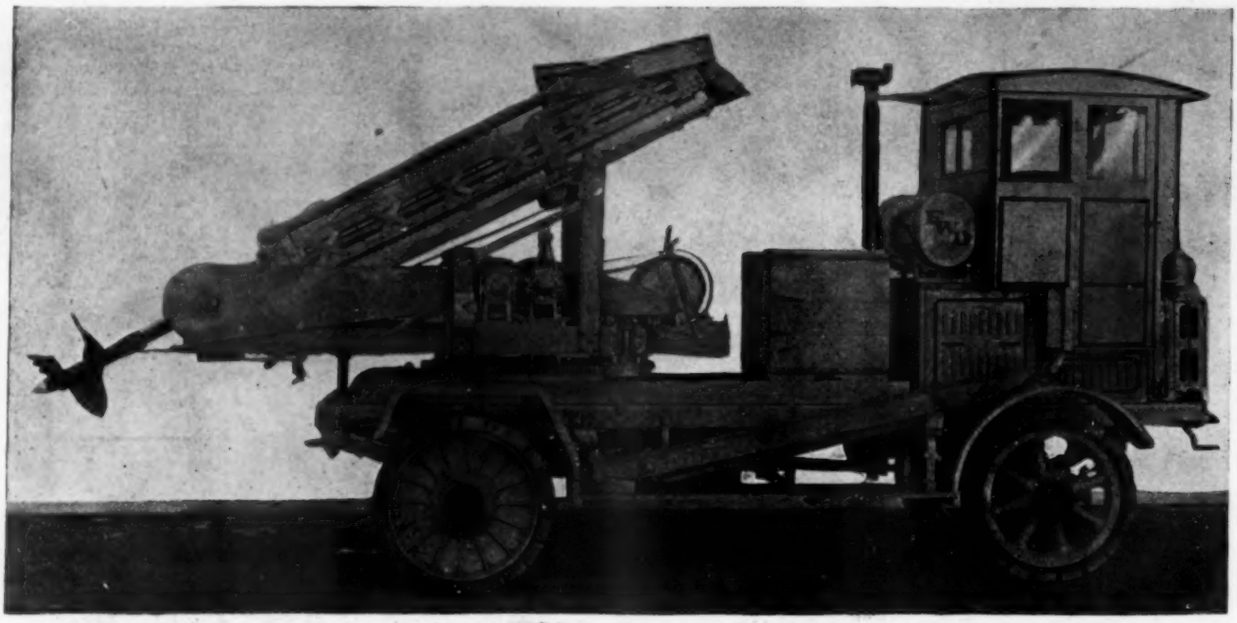


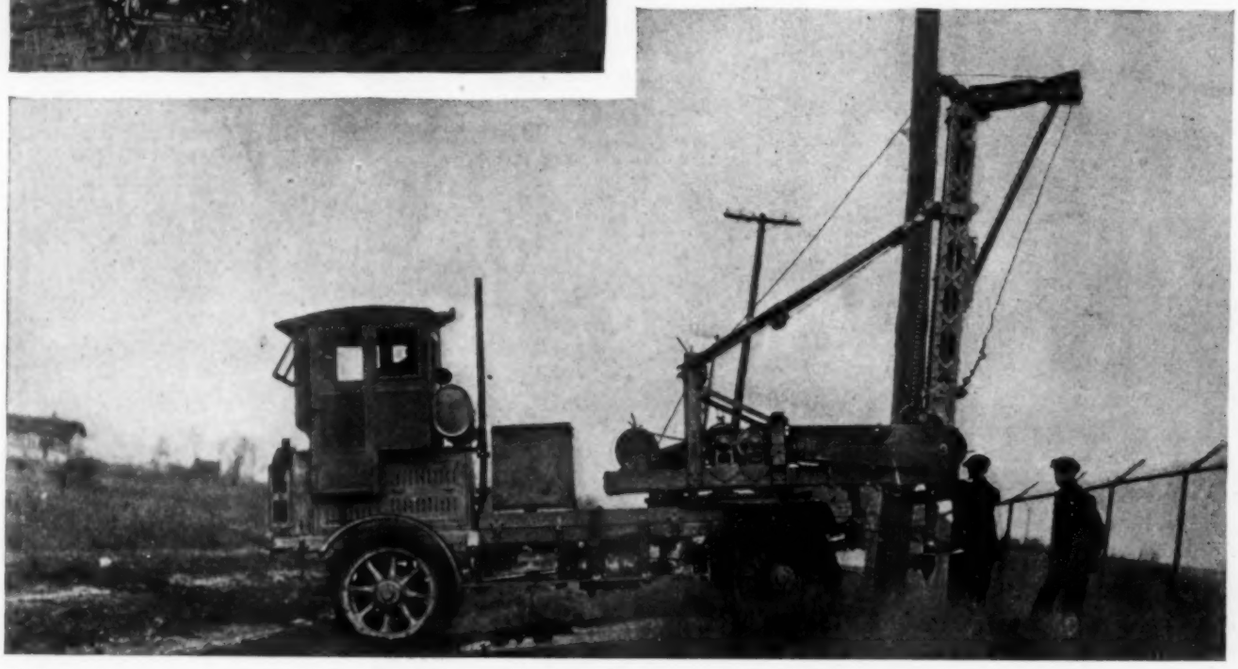
Setting Telephone Poles by Machinery

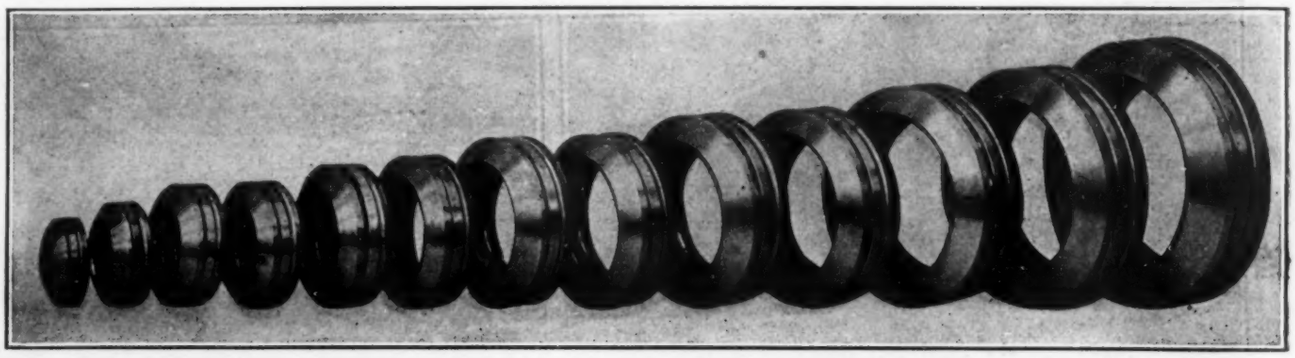
Above—The post-hole digger and pole setter, on four-wheel drive automobile chassis

Left—Digging a hole at the side of the truck

Below—Setting a pole

Photographs by courtesy of
The Four Wheel Drive Auto Co.,
Clintonville, Wis.





The Impressive Story of Fiat

Manufacture of Ball Bearings

By J. A. Lucas and F. E. Bardrof

Second article describing Fiat methods of ball bearing manufacture—Forging, hardening and grinding operations on the balls — Machining of separators and assembly of bearings

IN ORDER that ball bearings shall function properly it is, of course, necessary that the balls themselves shall be accurate in the highest degree. The methods employed in the Fiat ball bearing shops for the manufacture of the balls are comparatively simple, but exceptional care is taken to provide a product which is uniformly accurate and suitable for the service required. The selection of the material, the forging, the grinding, the hardening, and the rigid inspection are all factors which affect the ultimate quality of these parts, and it is only by a proper co-ordination of all these functions that satisfactory results are obtained.

Nearly all operations on the balls are performed on automatic machinery and the product is carefully checked and inspected at all steps of the process. Several of the inspection and test methods will be illustrated and described later.

The material used for the balls is a special chrome steel and the stock enters the shops in the form of round bars. From these bars short cylindrical pieces are cut, in which form the future ball comes to the forging presses. For those sizes of balls above 10 mm. in diameter the stock is heated before forging, and this hot-forging operation is shown in Fig. 19. A quantity of the cylindrical pieces before forging, together with the roughly shaped spheres produced, will be noted on the table of the press.

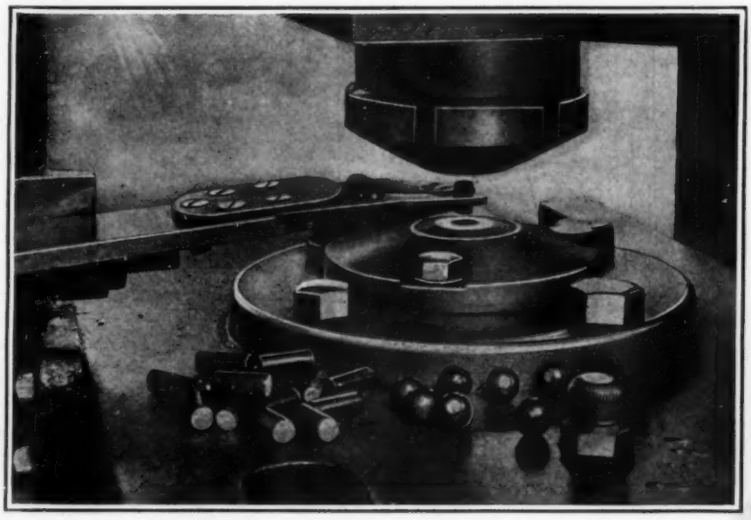
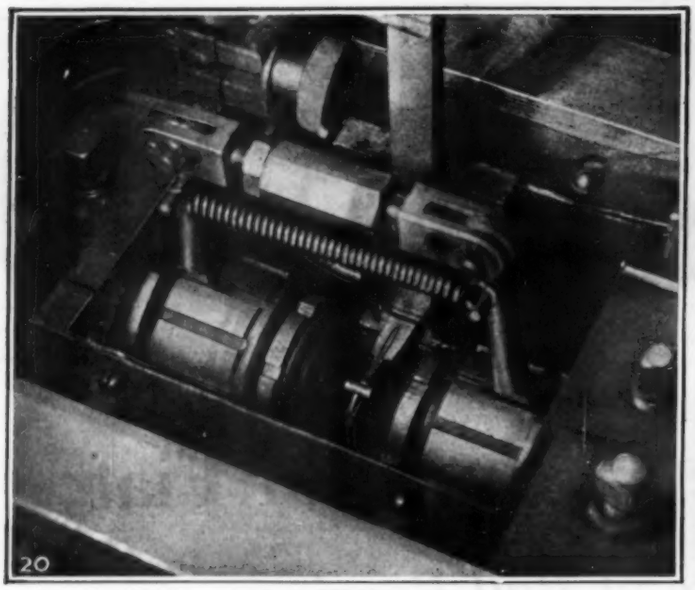


Fig. 19—Hot-forging larger sizes of balls

An automatic machine for cold-forging the smaller sizes is illustrated in Fig. 20. The blanks are dumped into a box located directly below the dies, from which they are extracted by an automatic mechanism and presented to the dies. The stock now begins to take the general shape of the finished ball, but it is a rough appearing object and a long series of grinding and hardening operations is required before the final, accurate, highly-polished ball is produced.

The first rough grinding of the forged ball is accomplished on the machine shown in Fig. 21, the detailed operation of the mechanism being more clearly illustrated by the diagram, Fig. 22. The balls are placed in the V-shaped slot between the non-rotating rings *C* and *C'*, through which they make contact with the ring-shaped grinding wheel *A* below. The rings *C* and *C'* can be moved vertically for



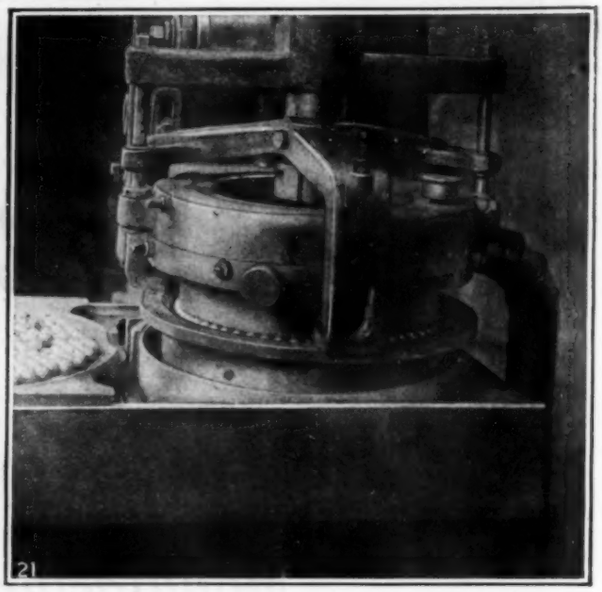


Fig. 20—Automatic cold-forging machine. Fig. 21—Rough grinding

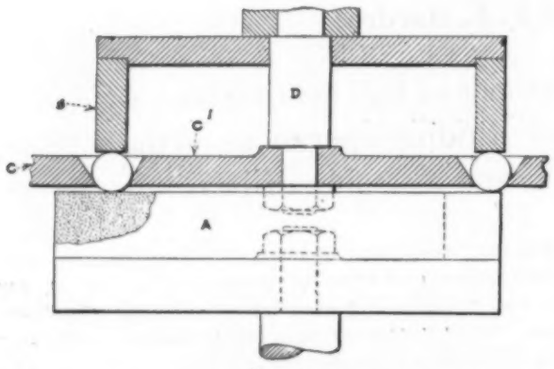


Fig. 22—Diagram of grinding machine details

the purpose of loading or unloading and, in the grinding position, the balls are held against the abrasive wheel by the steel ring *B* which rotates in the opposite direction.

It will be noted from Fig. 22 that the grinding wheel is not concentric with the slot in which the balls are placed, so that there is no danger of wearing a groove in the wheel. The balls rotate rapidly in the slot due to the combined action of the grinding wheel and the pressure ring and gradually approach a true spherical shape, since all parts of the ball surface are caused to come in contact with the grinding wheel. A considerable amount of metal is left and the balls are subjected to a second roughing operation before hardening. Except for an occasional measurement of diameter, these rough grinding operations are entirely automatic.

The machine on which the second rough grinding operation is performed is shown diagrammatically in Fig. 23, and consists essentially of a grooved grinding wheel *C*, mounted upon a horizontal shaft, and a grooved, stationary, cast-steel disk *A*. The series of grooves in both wheel and disk are concentric and in alignment with each other, the radius of the grooves being suited to the diameter of the balls to be ground. The grinding wheel is rotated by the belt pulley *D* and is pressed toward the disk by the spring *E*, to

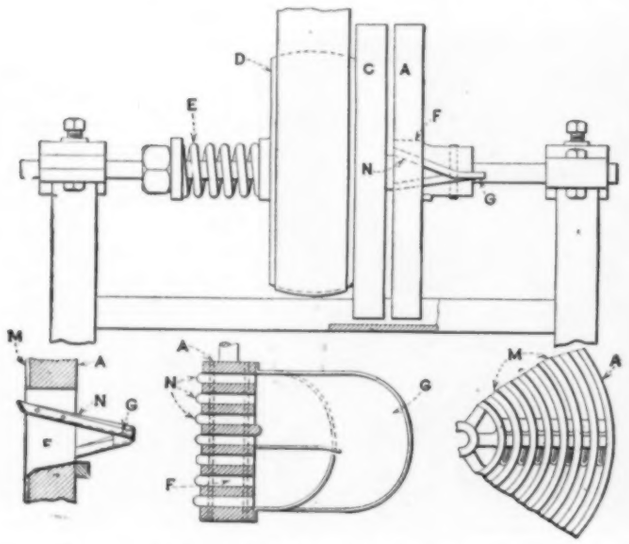


Fig. 23—Special machine for second roughing

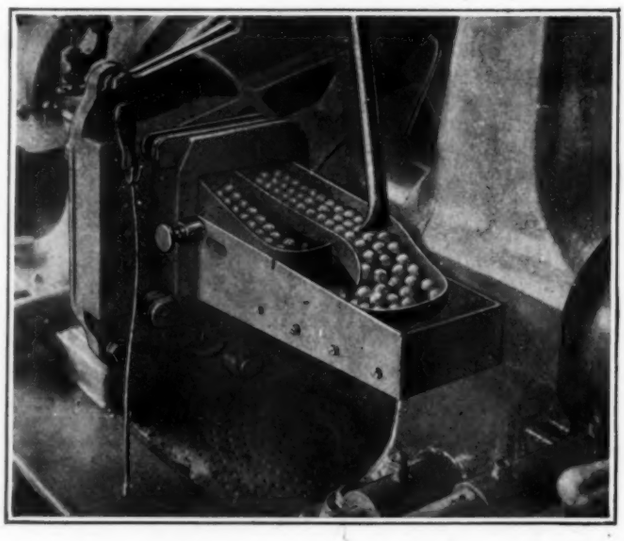


Fig. 24—Transfer chutes of special grinding machine

provide the necessary feeding action as the diameter of the balls is decreased.

The balls are fed into the grooves and travel along them as the grinding proceeds. Since the balls in the outer grooves would be ground more quickly by virtue

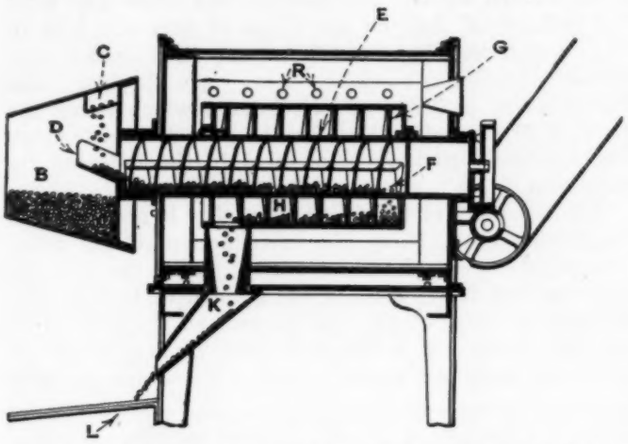


Fig. 25—Continuous heating furnace for hardening

of the greater surface speed near the periphery of the wheel, the apparatus shown in the lower part of Fig. 23 and illustrated in Fig. 24 is employed to transfer the balls between the outer and the inner grooves. The openings *F* are cut through the disk *A* on the horizontal axial plane and lead from each of the grooves *M* to the back of the disk. Spoon-shaped receivers *N* are placed in the openings to catch the balls as they come along the grooves and deliver them to the chutes *G*. The chutes deliver the balls from the three outer grooves to the four inner grooves and vice versa. This action gives uniform grinding conditions for all the balls, and high precision on both diameter and sphericity is a result.

The balls are now ready for the hardening operation and the continuous heating furnace shown in Fig. 25 is used. The essential parts of this furnace consist of a heating chamber and a double drum rotated inside the chamber by means of suitable worm gearing. The inside of each section of the double drum consists of a series of helical passages, so that an object such as a ball will travel the whole length of the drum as it is rotated. The balls are introduced into the barrel *B*, picked up at each revolution by the cup *C* and deposited in the chute *D* leading to the inner drum *E*, from which they are finally deposited through the hole *F* into the passage of the outer drum *H*. The helical partition *G* of the outer drum then causes the balls to travel back toward the loading end of the machine, to be dropped through the opening *I* into the chute *K* which leads to the quenching tank *L*. The position of the naphtha burners is indicated at *R*.

Final Temperature Closely Regulated

As the balls travel through the drums they are gradually heated to the required temperature but are entirely protected from the action of the flames by the walls of the drums. The final temperature can be closely regulated by adjusting the speed of the drum and the flame from the burners. Automatic control of the burners is provided, and a cone belt pulley furnishes means for adjusting the drum speed to suit the diameter of the balls in process. An exceptional uniformity of product is obtained through the use of this furnace and, when removed from the quenching tank, the balls are given thorough tests to determine if they are of the proper structure and hardness to suit the specifications.

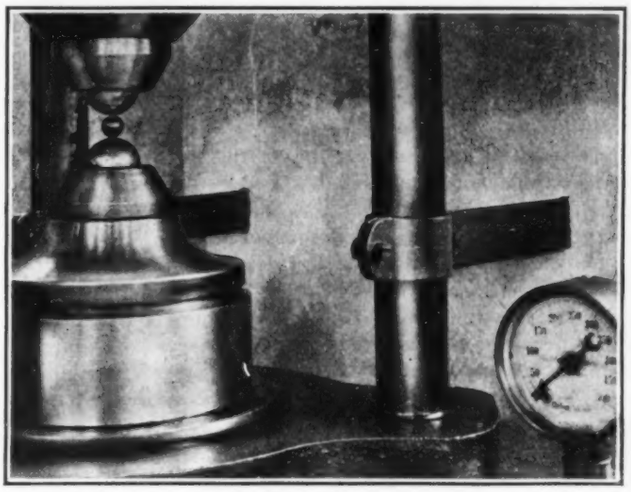


Fig. 26—Testing hardened ball under hydraulic pressure

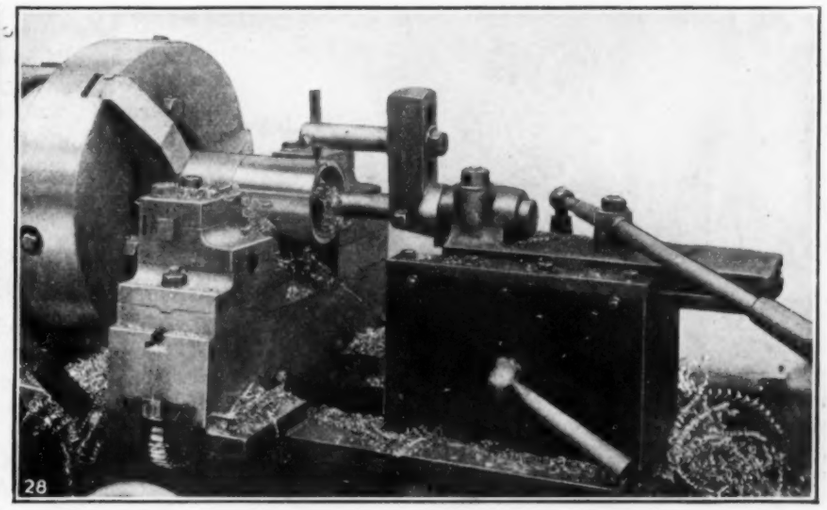


Fig. 27—Visual inspection of finished balls. Fig. 28—Turning separator rings from bronze tubing

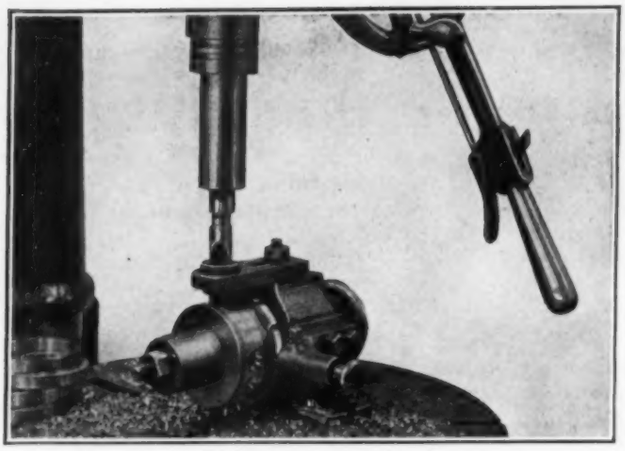


Fig. 29—Indexing jig for drilling ball holes in separator

The hydraulic press shown in Fig. 26 is used to fracture a small percentage of each batch of hardened balls, and this test gives a fairly good idea of the ultimate crushing load of the ball, as well as an opportunity to observe its inner structure. In another hardness test the balls are immersed in a liquid which, it is said, gives the surface of the balls a color depending on the hardness of the material.

Final Grinding and Polishing

The balls which pass the tests following the hardening operation are then ground to the finished diameter on machines very similar to the roughing grinder shown in Fig. 21, except that the wheels are much finer in grain and the pressures are much reduced. This operation reduces the diameter of the balls to the exact dimension required and the final polishing takes place in a leather-lined tumbling barrel where the balls are rotated with a quantity of small pieces of chamois skin for several hours. A special test micrometer which can measure to 0.001 mm. is then used to measure the final polished diameter, and Fig. 27 shows the final visual inspection for cracks or flaws. After this inspection the balls are ready for the bearing.

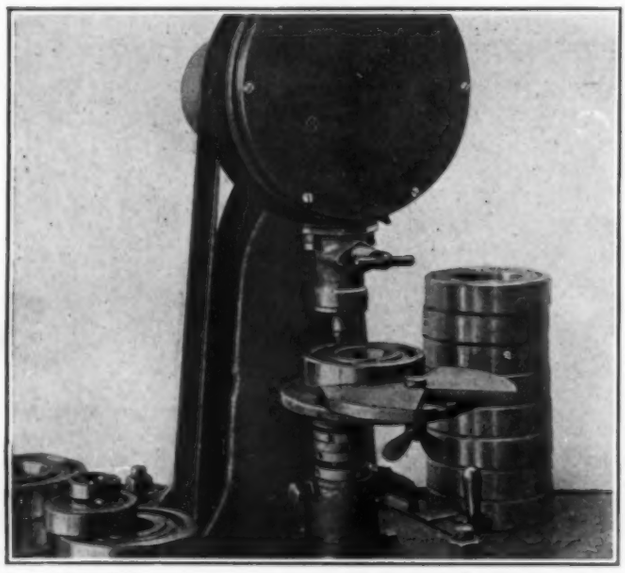


Fig. 30—Final riveting of separator

The separator which spaces the balls in the bearing is formed by two bronze rings riveted together, and the rings for radial bearings are machined from tubing as shown in Fig. 28. The turning and boring tools are mounted in the longitudinal tool slide and tools for cutting off four or five rings at once are held in the cross-slide. The rivet holes are then drilled in a sensitive drilling machine, using special jigs. The operation of drilling the radial holes which locate the balls is illustrated in Fig. 29, the pair of bronze rings for a single separator being held in the indexing jig as shown.

The assembly of the finished bearing is accomplished in three steps: First, the introduction of the balls; second, assembly of the separator; third, the final inspection and test. Half of the number of balls is first introduced between the cold races, and the outer race is then heated to between 60 and 70 deg. C. by an electrical heating element. This temperature produces sufficient expansion of the ring so that the balls will just slip into the bearing.

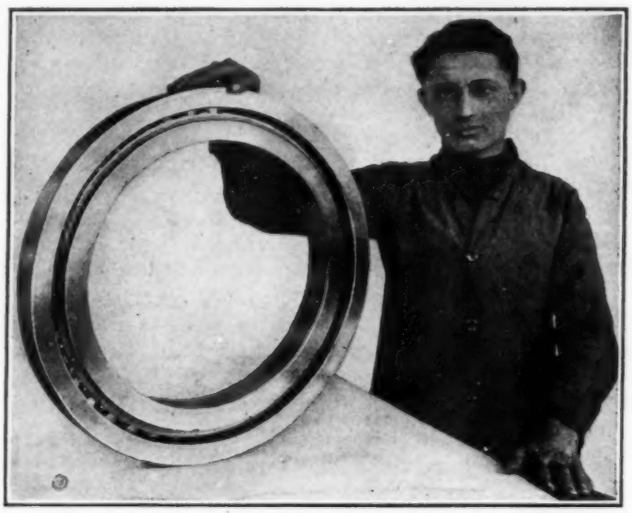


Fig. 31—Largest and smallest radial bearings made by Fiat

The separator sections are placed in position and riveted together by a press as illustrated in Fig. 30, the pressure applied to each rivet being constant and always indicated by a pressure gage. The completed bearing, after final inspection, is washed in kerosene, wrapped in waxed paper, and is ready for the user. Fig. 31 shows the largest and smallest radial bearings manufactured at Fiat.

German Competition in Machinery Diminishing—Erratum

In an article entitled, "German Competition in Machinery Diminishing," on page 20, Vol. 60, *American Machinist*, an error occurred in that figures representing the half-yearly exports of industrial machinery from Germany were referred to in the text as representing only the month by which this period was designated. According to the Verein Deutscher Maschinenbau-Anstalten, it is German custom to refer to a half-yearly period as June 1922 or January 1922, the month named being the last in that period.

Locomotive Tire Practice on the Santa Fé

By Fred H. Colvin
Editor, *American Machinist*

Wheel gages and calipers, and how they are used—Mating of tires by carbon content as well as size—Standard shims—Shrinkage allowance

AMONG the many standards evolved by the engineers of the Santa Fé system, is the practice of fitting locomotive tires. The large number of locomotives in service on this road and the varying requirements to meet the conditions of the different divisions in widely separated sections of the country, make the experience gained of great value to others.

New tires, for both driving and trailing wheels, are purchased in the rough, and with sufficient stock on the insides to finish $\frac{3}{8}$ in. smaller than the nominal outside diameters of the wheel centers. New driving-wheel tires are applied in complete sets only, and are mated as closely as possible, both as to outside diameter and carbon content of the material. The carbon content should not vary over 0.05 per cent, and is indicated on the tire by the letter *C* followed by the number of points, i.e., *C*66 signifies carbon 66 points or 0.66 per cent.

Before applying new tires, wheel centers are carefully inspected both for roundness and concentricity, or "out of center" with the axle. If there is more than $\frac{1}{16}$ in. variation in either case, the wheel center must be trued up in a wheel lathe, with the axle between the centers. Wheel centers are tested for out of roundness at two points 90 deg. apart, as at *A-A* and *B-B*, Fig. 1. At *B*, Fig. 6, the caliper used is shown in detail.

Testing for out of roundness is done as in Fig. 2, using the special gage shown at *A*, Fig. 6. With the half-ball centers in the axle, the two fingers at *A*, Fig. 2, show how true the outside is with the axle. The gage can be used on each side of the crankpin and so tests nearly the whole circumference of the wheel center.

The insides of the tires are bored to suit the individual wheel centers. The wheel centers must permit proper spacing of tires without reducing the thickness of the lips below $\frac{1}{4}$ in. This is shown in Fig. 3. Any variation in diameters of treads of tires mounted on the same axle, or coupled together by side rods into the same set, or found out of round, out of center, or out of true laterially, must be corrected. On articulated locomotives, a variation of $\frac{1}{2}$ in. in the diameters of wheels in different units is permissible.

The use of shims between tires and wheel centers is to be avoided where possible, but shims may be used, in accordance with the accompanying table when necessary

Table of Widths and Thicknesses of Tire Shims

Widths			Thickness	
			In Decimals	In Inches or B.W.G.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.010	31 B.W.G.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.014	28 B.W.G.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.020	$\frac{1}{64}$ in.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.032	$\frac{1}{32}$ in.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.049	$\frac{3}{64}$ in.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.065	$\frac{1}{16}$ in.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.072	$\frac{5}{64}$ in.
$1\frac{1}{4}$ in.	$3\frac{1}{4}$ in.	$5\frac{1}{4}$ in.	0.109	$\frac{7}{64}$ in.
.....	.....	$5\frac{1}{4}$ in.	0.125	$\frac{1}{8}$ in.
.....	.....	$5\frac{1}{4}$ in.	0.156	$\frac{5}{32}$ in.
.....	.....	$5\frac{1}{4}$ in.	0.187	$\frac{3}{16}$ in.
.....	.....	$5\frac{1}{4}$ in.	0.219	$\frac{7}{32}$ in.
.....	.....	$5\frac{1}{4}$ in.	0.250	$\frac{1}{4}$ in.

to secure the proper shrinkage allowance in applying tires. The allowance is $\frac{3}{64}$ in. per foot of diameter of wheel center. All tires must be allowed to cool gradually after shrinkage, and all methods of cooling by water are prohibited.

The shims are of a soft quality of steel and come in 8-ft.

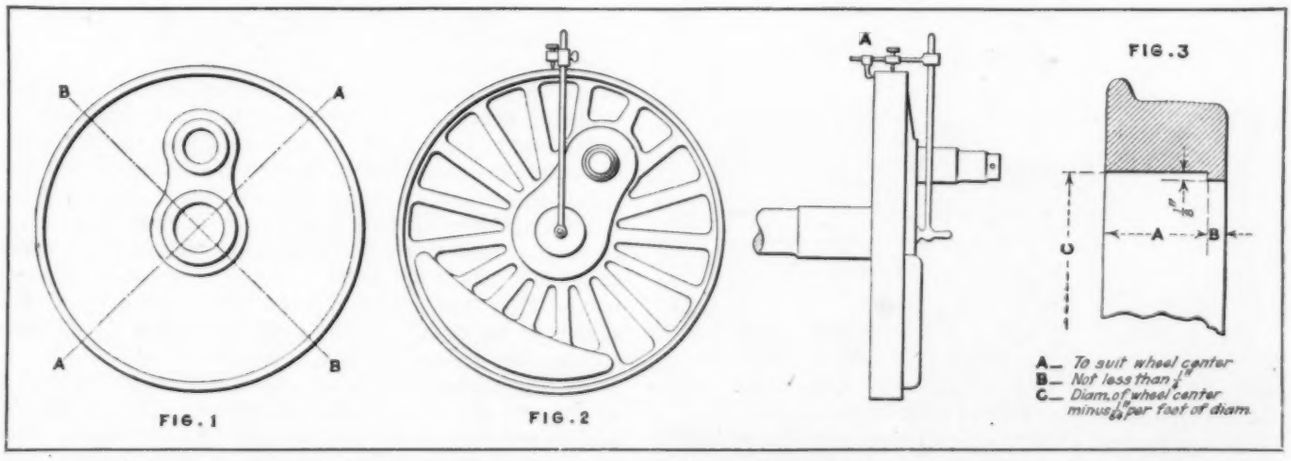


Fig. 1—Measuring wheel center for roundness. Fig. 2—Testing wheel center for concentricity. Fig. 3—Detail of tire boring

lengths, or else in coils. The table shows the widths and thicknesses, both in decimals and in the Birmingham gage. The shrinkage allowance left by the use of shims must be the same as without them. No building up is permissible; the required thickness must be secured

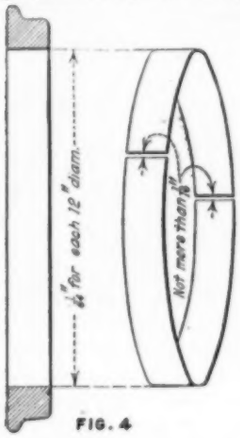


FIG. 4

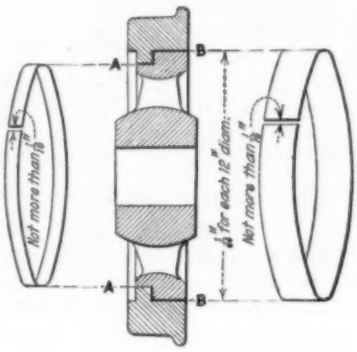


FIG. 5

Fig. 4—Shims for use on driving wheels. Fig. 5—Using two shims on truck wheels

with a single strip, which should form a continuous band inside the tire, and as shown in Fig. 4 with not more than a ⅛-in. gap between shim ends.

When shims are used on driving wheels, they are approximately the full width of the tire. On trailer truck wheels, such as shown in Fig. 5, two shims are necessary. A narrow shim, at *A*, and a wider one, at *B*. All other conditions, such as the permissible gap between

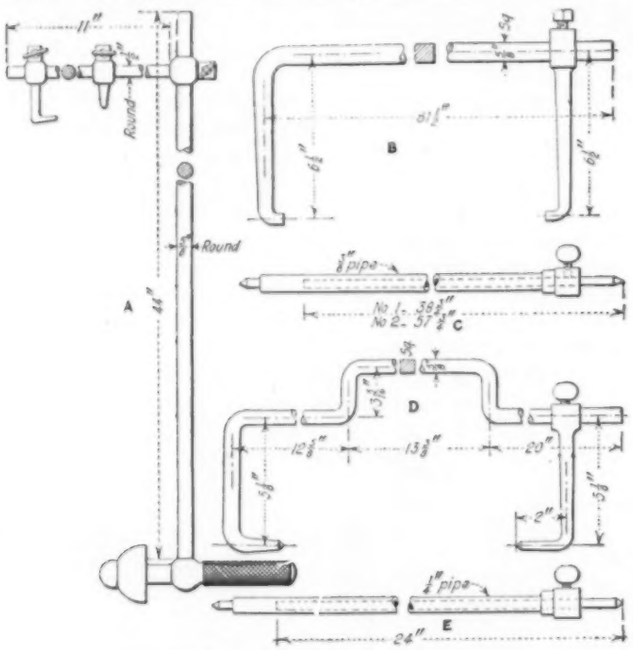


Fig. 6—Wheel-center and tire gages

the ends, remain the same. New tires are applied without the use of shims. Tires that work loose in service may be shrunk on with shims to tighten them. In no case should the shim exceed ¼-in. in thickness.

Driving-wheel centers of cast steel sometimes develop flattened rims—occasionally from the welding of broken spokes. In such cases the flattened spots are to be built up by autogenous welding and the wheel center trued up. Cast-steel driving-wheel centers that have been reduced more than ⅜-in. in diameter below the nominal size, are to be built up by welding and then turned to the nominal size.

A number of useful gages, two of which have been previously mentioned, are shown in Fig. 6. The use of gages *A* and *B* has already been described. Gages *C* and *E* are very similar, the main difference being as to size. The first is used for the insides of driving wheel tires, the other for truck, trailer and coach-wheel tires. Gage *D* is for calipering the outside diameters of engine-truck, tank and coach wheel-centers and tires. The offset in the center of the gage allows it to be used over the ends of the axles and boxes.

Automobile Piston Clearances—Discussion

By James McIntosh

In an article under the title given above and published on page 187, Vol. 60, of the *American Machinist*, Douglas Muirhead has, it seems, some exception to make with regard to my letter on piston clearances. Referring to my statement regarding the added weight as being of questionable value, Mr. Muirhead says, "This is only partially true." Is a heavy piston an advantage? I say it is not, but I do say that heat conductivity, not weight, is an advantage. Thus an aluminum piston of the same weight as one of cast iron is used to assimilate heat and make the use of higher compression pressure possible.

What I did say was, that any additional weight in excess of that required for a given heat-flow is a defect, while any less is also a limiting factor, and will cause pre-ignition, due to the use of high compression pressure.

I repeat my contention that the design and material used, and the ability of both to dissipate and transfer piston-crown heat will decide the compression pressure it is possible to use. This in turn will decide the temperature of a piston skirt, also the amount it must be less than the cylinder bore at all points in diameter.

The conditions in an automobile engine capable of developing over 70 hp., but operating at less than one-third power for 90 per cent of the running time, is the result of American practice.

As against European practice, 10 to 15 hp. and the use of a speed box for every little grade, tends to upset the conditions cited above. The former is operating at low thermal and mechanical efficiency 90 per cent of the time, while the latter is operating at a more constant load and developing its power at the best efficiency.

My suggestion as to the only safe way to decide the diameter of any piston is to fit it slightly oversize and use it in an engine under its own power, bringing the engine up to maximum horsepower or over, due to increased compression, by adding to the distance from the piston pin to the crown (for experimental purposes only. This will assure a safe limit and determine a diameter based upon actual conditions, plus a safe margin to compensate for an overload.

This procedure takes into consideration every factor in the piston and every bore condition. As a result, the piston will wear itself to size in an experimental engine of given characteristics, and furnish data for that condition in a simple and reliable way, so that definite data can be put on a drawing for the finished product.

Machining Motor Bus Axle Housings

By Howard Campbell
Western Editor, *American Machinist*

Machining the largest rear axle housing forging yet developed—Using a gun-drilling machine in an automotive plant--A multiple drilling operation in an engine lathe

THE REAR AXLE for a motor bus that weighs nearly 12,000 pounds and can carry an additional load of 67 passengers must, of necessity, be able to stand the stress incidental to the task for which it was designed. The rear axles of the buses built for their own use by the Yellow Coach Mfg. Co., Chicago, Ill., are made by the Timken-Detroit Axle Co., Detroit, Mich. The most important part is, of course, the housing, which is a steel forging weighing 550 pounds as it comes from the forge shop. The general dimensions of the finished piece are shown in Fig. 1.

The first operation is that of drilling the center holes. The flanges are then rough turned and faced in the 24-in. Pittsburgh lathe shown in Fig. 2. The amount of stock taken off the face of the flange varies from $\frac{1}{8}$ in. near the edge to approximately $1\frac{1}{4}$ in. near the center,

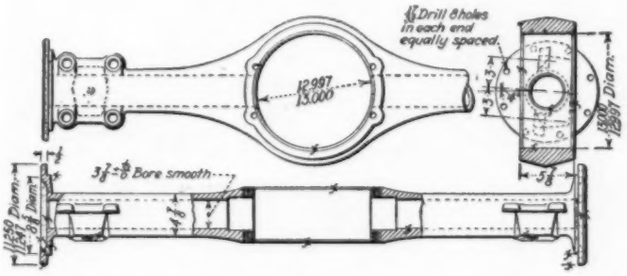


Fig. 1—Drawing of bus rear axle forging

due to the draft in the dies. Approximately $\frac{1}{2}$ in. comes off the periphery. The piece is held by clamps on the face-plate at one end and by the tail-stock center at the other, and is supported by a steady-rest located as close to the cutting tool as possible. The tool is of 1x1¼-in. high-speed steel, and feeds at a rate of 0.020 in. per revolution of the work. The work speed is 25 r.p.m., or approximately 74 ft. per min. A production of two housings in nine hours is obtained.

The next operation consists of facing and roughing out the bowl, using a Niles horizontal boring machine, Fig. 3. The piece is clamped in a fixture which locates it centrally, and which carries a guide for the end of the boring bar. The heads that carry the boring and facing tools are on separate spindles, one inside the other. Both tools operate at the same time, the facing tool being controlled by a star feed. The bowl contains from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. of surplus stock, all of which is taken out in one cut with the exception of the few thousandths that are left for the finish cut. The tool, which is of 1x1¼-in. high-speed steel, makes 14 r.p.m., while traveling at a rate of 0.011 in. per revolution. Four pieces can be finished in nine hours.

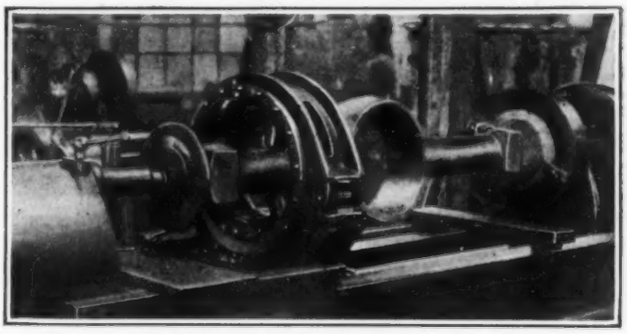


Fig. 2—Rough turning and facing flanges

After the bowl has been roughed out, the piece goes to the machine shown in Fig. 4, where the hole for the axle is drilled. This hole is drilled from the solid to a diameter of 3⅞ in., a No. 3 Pratt & Whitney gun drilling machine being used for the job. One end of the forging is clamped to the face plate and the other end is held in a steady-rest which also carries a guide for the drill. The drill passes through 25 in. of solid stock at each end, the piece being reversed, of course, after one end is drilled. The tool feeds in at a rate of 0.007 in. per revolution, while the piece revolves at 60 r.p.m., or at a cutting speed of about 61 ft. per min. The tool is kept cool and the cutting operation facilitated by a

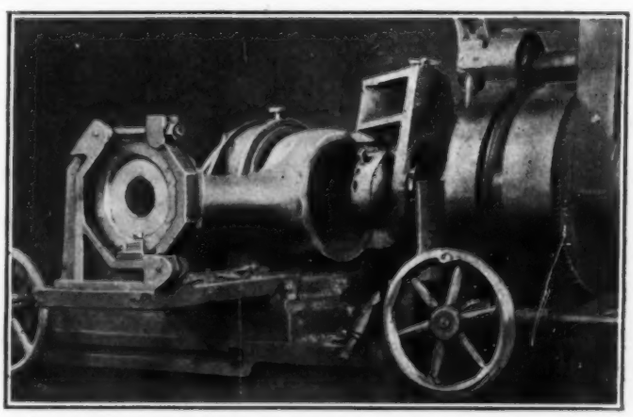


Fig. 3—Rough boring and facing the bowl

copious flow of deep-drilling oil, which reaches the point of the drill through two brass tubes that extend lengthwise through the drill. The oil is pumped to the drill under a 90-lb. pressure. An axle can be drilled in approximately three hours.

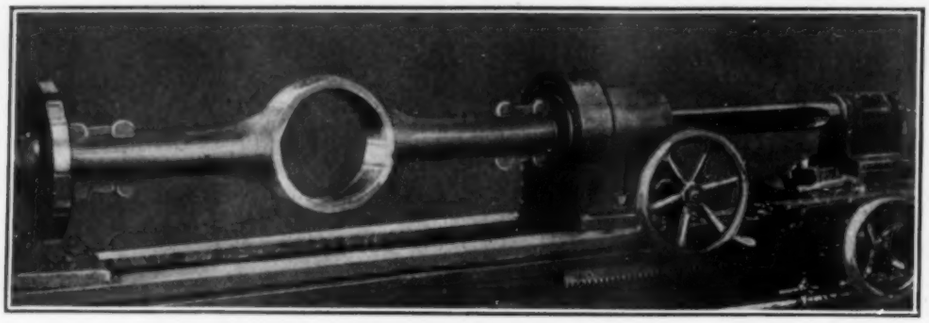


Fig. 4—Drilling a 3¾-in. hole, 25 inches long

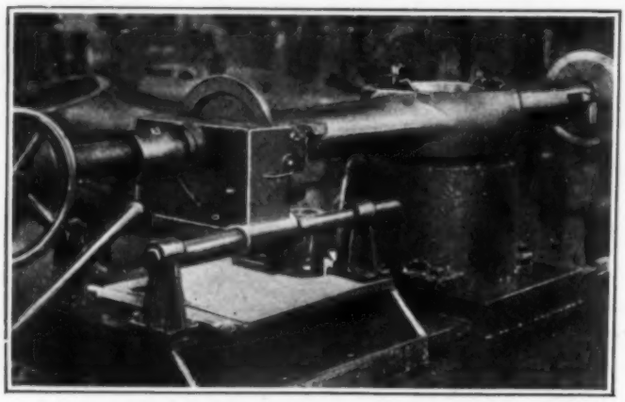


Fig. 5—Reaming ends for oil retainers

After the drilling operation is completed, the piece is hardened and heat-treated to a Brinell test, and then goes back to the machine shown in Fig. 3 for the finish boring operation in the bowl. The same set-up is used as for the roughing operation and the hole is bored to finish size within a limit of 0.003 in. Five pieces in nine hours can be obtained on this operation.

A hole for an aluminum oil retainer now has to be reamed out in each end of the piece to a depth of 4⅜ in., an operation that is performed as shown in Fig. 5. A left-hand spiral reamer with 13 teeth is used for the roughing operation, which takes out ⅛ in. of stock at a speed of 14 r.p.m., feeding at the rate of 0.008 in. per revolution. A similar tool with eight teeth is used for the finish cut. Approximately 0.030 in. is removed in the finish cut, the diameter being held within a limit of 0.002 in. Black oil is used as a coolant. Both ends of the piece are finished in approximately 45 minutes.

The piece now goes to the machine illustrated in Fig. 6, where the bolt-holes in the flanges are drilled. The machine is a Pittsburgh lathe, equipped with a multiple head carrying eight ¾-in. drills, the spindles of which are driven by gears operated by a driving gear on the spindle of the machine. The piece is clamped to a fixture on the carriage of the lathe as shown, and is properly aligned by applying the tail-stock center to the center hole in the end of the piece. The drills are fed by hand and are kept cool by a stream of cutting compound. Both ends of the piece are drilled in 10 minutes.

The illustration Fig. 7 shows the set-up for the next operation—that of milling the spring seat pads. The machine is a Cincinnati vertical milling machine, using an 8-in. inserted tooth milling cutter. The cutter revolves at a speed of 32 r.p.m. and removes ¼ in. of stock at a feed of 1¼ in. per minute. Only one cut is required.

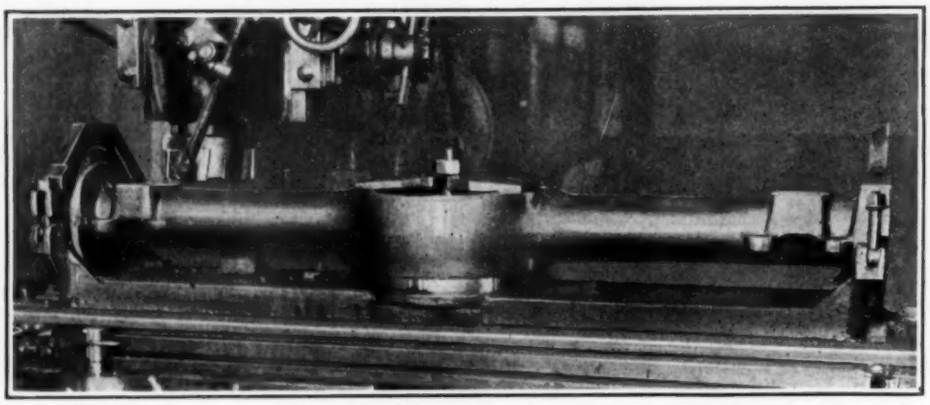


Fig. 7—Milling spring seats

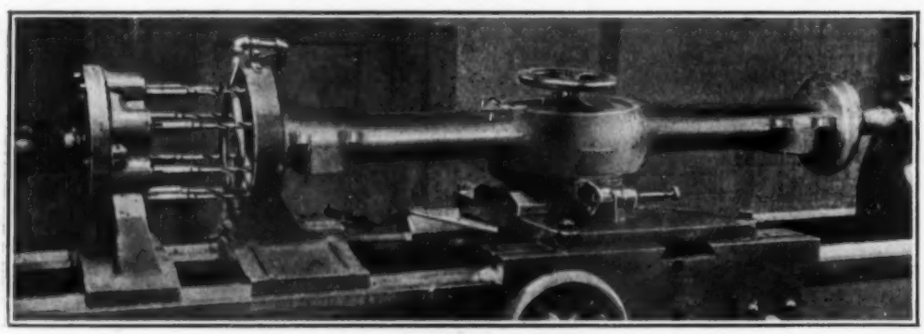


Fig. 6—Drilling bolt-holes in flanges

Compound is used to keep the cutter cool. The piece is located on the fixture on a 5-deg. angle, which produces a corresponding angle on the spring seat, in relation to the bore and face of the bowl. The time required for this operation, floor to floor, is 20 minutes.

The finished part is amply strong to withstand the severe strains set up when a fully loaded bus hits a bump.

A Double-Spindle Production Milling Machine

Special Correspondence

Sundstrand machine recently developed by the Rockford Milling Machine Co.—Work held on special turret—Cutters on two spindles — Wide range of feeding movements

A RATHER unusual development in the milling machine field has recently been completed by the Rockford Milling Machine Co., Rockford, Ill., and, as a result, the company is now marketing the Sundstrand, double-spindle, high-production milling machine. Even a cursory inspection of the accompanying illustrations serves to show that the design of this machine departs considerably from the usual appearance of the standard milling machine, to which we have become accustomed. In its essentials the machine consists of a work-holding turret on a horizontal shaft and a sliding spindle head, both mounted on a substantial, strongly-ribbed base. The action of the cutters on the work is controlled by various combinations of the rotation of the turret and the motion of the spindle head, so that the machine is not a single-purpose tool but is available for a considerable variety of work.

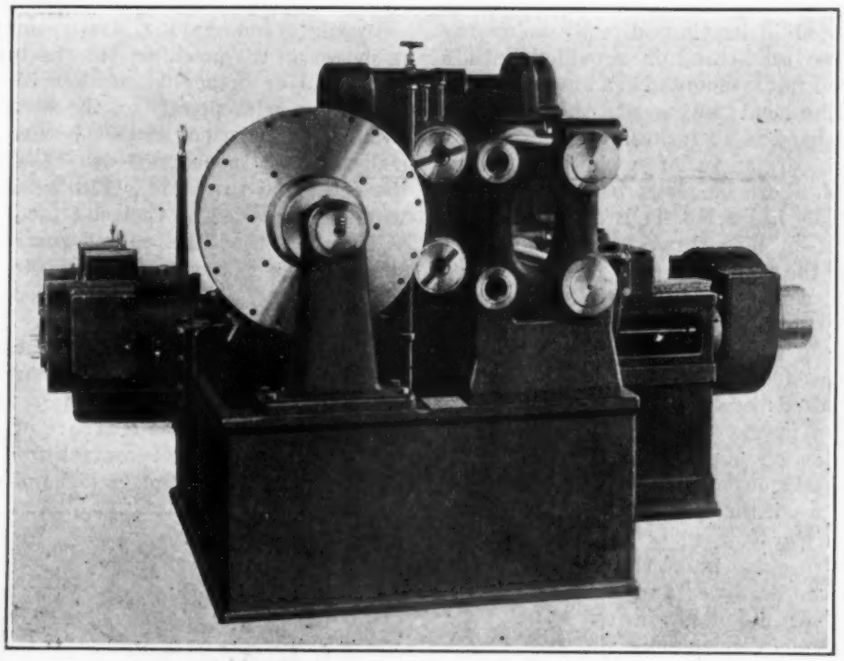


Fig. 1—Sundstrand Double-Spindle Production Milling Machine

With the spindle head stationary and the turret revolving, continuous milling can be performed or, if desired, the turret can be caused to rotate as one piece is milled and then indexed to bring the next piece into contact with the cutters. For gash-milling the turret can be indexed and held stationary as the cutters are fed in and perform the operation, after which the cutters will back out and the turret will index to the next position. It is stated that this action is faster and more satisfactory for gash-milling than feeding the work past the cutter. The turret can be indexed either four or eight times to the revolution of the drum.

The spindle head carries two spindles and this feature permits roughing and finishing a piece without removing it from the turret, the roughing cutters being carried on the upper spindle and the finishing cutters on the lower one. The life of the cutters is increased by this procedure and a close degree of accuracy is maintained, as the finishing cutters are used merely to rectify the surface produced by the roughing cutters. Although the roughing cutters may become slightly dulled the finishing tools will produce a smooth, well-finished surface. Where mass production is required, both the upper and lower spindles may be used for roughing, a simple adjustment being made on the feed drum, and the turret indexing two stations at a time. The left-hand end of the machine in Fig. 1 is the operating end. From this position the loading of the work on the turret is conveniently done and the controls are within easy reach. The base of the machine is a heavy one-piece casting, strongly ribbed and provided with ample bearing surfaces for the turret drive mechanism and the spindle head. A compartment *P*, Fig. 2, is located under the turret and cutters, and arranged to receive the chips and serve as a reservoir for coolant.

The sliding spindle head *A*, Figs. 2 and 3, is rigidly constructed and is mounted on the base at the rear of the turret *B*. The bearing of the head on the base is long and wide, and the sliding movement of the head is guided by the dovetailed way *C* fitted with a taper gib. This construction decreases the tendency to twist. The

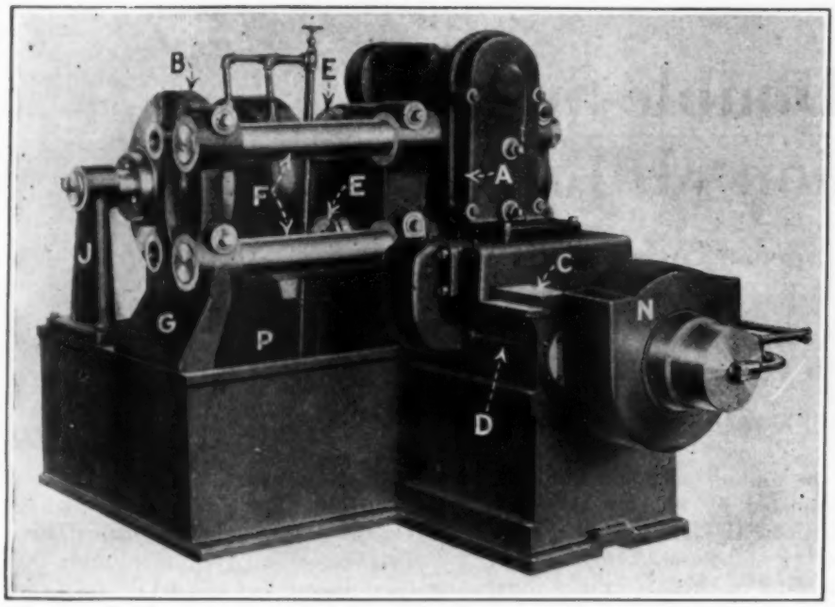


Fig. 2—Driving end of Sundstrand milling machine

feed screw *D* is carried in bearings directly below the center of the way or guide and is provided with a take-up nut. The feed nut is mounted in a bracket that is securely attached to the head casting, and the maximum travel of the spindle head is 10 inches.

The spindles *E* are carried in large phosphor-bronze bearings in the head, these bearings being adjustable for wear. Each spindle has a No. 11 B & S taper hole in the nose and a $\frac{11}{16}$-in. hole through the center. A large wormwheel on the upper spindle is driven by a hardened and ground worm running in roller bearings, change gears being provided for 11 changes of speed, ranging from 17 to 156 r.p.m. Since the lower spindle is most frequently used for finishing cutters, change gears are also interposed between the spindles, so that the lower may be run at the same speed as the upper for roughing operation on mass production, or at the higher speeds required for finishing. A distance of 11 in. is provided between the centers of the spindles.

The spindle drive mechanism runs in a bath of oil and the hardened and ground shafts are all mounted in roller bearings. The main drive consists of a long, horizontal gear mounted in the bed and meshing with a gear in the head. As the head slides along the bed, the follower gear slides along the driver which is sufficiently long to keep the gears in mesh throughout the maximum travel of the head.

An outboard support *G* for the cutter arbors is attached to the head by two heavy 4-in. rods *F*. The distance from the face of the spindle to the arbor support is 20 in. The support rests on a machined pad on the base of the machine but is not attached since it must slide with the head. However, a substantial support is provided because the direction of the cut is upward and the cutters therefore bear downward. It is said that there is no tendency to chatter or vibration and that this construction provides an unusually good support for the arbors.

The heavy shaft *H*, Fig. 3, on which the turret is mounted remains stationary during the operation of the machine and is rigidly supported at at each end. The turret housing *I* holds one end of the shaft, and is carried on the bed by means of a dovetailed slide and ample bearing and clamping surfaces that reduce the tendency to vibration. The outer end of the turret shaft fits into the outboard bearing *J*, Fig. 2, rigidly bolted to the bed, the center of the turret being 36 in. above the floor. The turret housing has an adjustment range of 4 in. parallel to the spindles, a convenient arrangement when setting up different jobs and aligning the cutters with the work.

In the accompanying illustrations a circular turret is shown on the machine, but the turret may be square, hexagonal or octagonal, if desired. The shape of the turret depends entirely on the work for which the machine is to be used, and each turret is designed especially to suit the conditions. The working surface of the octagonal turret is 8½x13 in. and two T-slots $\frac{5}{8}$ in. wide are provided on each flat face.

The fact that the turret revolves on a stationary shaft makes it more convenient to change turrets for different jobs, since it is not necessary to remove the shaft and its driving mechanism. The turret carries a gear of large diameter that meshes with a pinion mounted on the shaft of a wormwheel by which it is driven. All gears for driving the turret are well guarded to prevent the entrance of dirt or grit.

The automatic feed control for turret and spindle head is mounted at the right-hand end of the machine

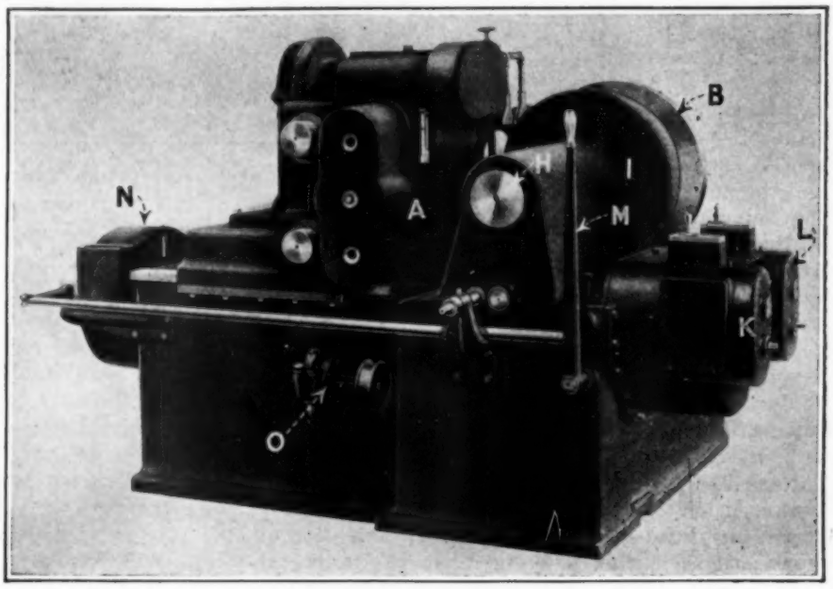


Fig. 3—Rear view of Sundstrand milling machine

in Fig. 3. The different combinations of feeds are obtained by the adjustment of two revolving drums inclosed in the casings *K* and *L*. The left-hand drum *K* controls the turret and, by shifting the control handle, the various feeding motions of the turret, previously mentioned, can be obtained. The right-hand drum *L* controls the feed of the spindle head. Seven changes of feed are provided and range from 1.4 to 9.7 in. per min. The rapid indexing of the turret takes place at 2 r.p.m., the maximum swing of the turret being 38 inches.

The machine can be arranged for either belt or motor drive, a single driving pulley being located at the end of the machine and enclosed by the belt guard *N*. The clutch for starting and stopping the machine is located at the end of the driveshaft and is operated by the lever *M*, Fig. 3. The driving pulley is 16 in. in diameter with a 5-in. face, and should run at 600 r.p.m. For motor driving a motor with a capacity from 7½ to 10 hp. and running at 1,200 r.p.m. is recommended. The motor is arranged to drive through a silent chain.

The coolant pump *O*, Fig. 3, is accessibly located and is driven by a belt from the main drive shaft of the machines. The floor space required measures about 66x98 in., and the net weight of the machine is approximately 9,000 pounds.

Standardizing Tolerances for Taps—Discussion

BY C. M. POND

I have read with considerable interest Walter Daley's article on the above subject as published on page 217, Vol. 60, of the *American Machinist*, and it occurs to me that Mr. Daley and others may be interested in additional and corrected standards adopted by the Tap and Die Institute, and shown in Table 9, herewith.

This table gives the tolerances for S.A.E. standard nut and tapper taps and has been revised so that these tolerances correspond to those for S.A.E. standard hand taps. because it has been found that the products upon which the S.A.E. tapper taps are used are almost entirely those of the automobile and automobile accessory manufacturers. These manufacturers are demanding a closer fit for their tapped parts and, in order to meet this demand, the tap and die manufacturers have decreased the tolerances on the S.A.E. standard nut and tapper taps.

In addition, Table 9 now lists also the tolerances for A.S.M.E. standard tapper taps.

TABLE 9
Commercial Tolerance for Nut and Tapper Taps

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
S. A. E. Standard								
¼-28	.2500	.2268	.0010	.0035	.0025	.0005	.0020	.0015
5/16-24	.3125	.2854	.0010	.0035	.0025	.0005	.0020	.0015
3/8-24	.3750	.3479	.0010	.0035	.0025	.0005	.0020	.0015
7/16-20	.4375	.4050	.0010	.0040	.0030	.0005	.0025	.0020
½-20	.5000	.4675	.0010	.0040	.0030	.0005	.0025	.0020
9/16-18	.5625	.5264	.0010	.0040	.0030	.0005	.0025	.0020
⅝-18	.6250	.5889	.0010	.0040	.0030	.0005	.0025	.0020
11/16-16	.6875	.6469	.0010	.0050	.0040	.0005	.0030	.0025
¾-16	.7500	.7094	.0010	.0050	.0040	.0005	.0030	.0025
7/8-14	.8750	.8286	.0010	.0050	.0040	.0005	.0030	.0025
⅞-18	.8750	.8389	.0010	.0050	.0040	.0005	.0030	.0025
1-14	1.0000	.9536	.0010	.0050	.0040	.0005	.0030	.0025
1 1/8-12	1.1250	1.0709	.0015	.0060	.0045	.0005	.0035	.0030
1¼-12	1.2500	1.1959	.0015	.0060	.0045	.0005	.0035	.0030
1⅜-12	1.3750	1.3209	.0015	.0060	.0045	.0005	.0035	.0030
1½-12	1.5000	1.4459	.0015	.0060	.0045	.0005	.0035	.0030
A. S. M. E. Standard								
2-56	.086	.0744	.0015	.0040	.0025	.0010	.0030	.0020
2-64	.086	.0759	.0015	.0040	.0025	.0010	.0030	.0020
3-48	.099	.0855	.0015	.0040	.0025	.0010	.0030	.0020
3-56	.099	.0874	.0015	.0040	.0025	.0010	.0030	.0020
4-36	.112	.0940	.0020	.0045	.0025	.0015	.0035	.0020
4-40	.112	.0958	.0020	.0045	.0025	.0015	.0035	.0020
5-40	.125	.1088	.0020	.0045	.0025	.0015	.0035	.0020
6-32	.138	.1177	.0020	.0045	.0025	.0015	.0035	.0020
6-40	.138	.1218	.0020	.0045	.0025	.0015	.0035	.0020
8-32	.164	.1437	.0020	.0045	.0025	.0015	.0035	.0020
10-24	.190	.1629	.0020	.0045	.0025	.0015	.0035	.0020
10-32	.190	.1697	.0020	.0045	.0025	.0015	.0035	.0020
12-24	.216	.1889	.0020	.0045	.0025	.0015	.0035	.0020
14-20	.242	.2095	.0020	.0050	.0030	.0015	.0040	.0025
14-24	.242	.2149	.0020	.0050	.0030	.0015	.0040	.0025

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

Looking Backward

BY J. P. POLAND

I trust that I am not presuming too far upon the consideration that the Editorial staff of the *American Machinist* feels for its older readers in venturing to write of my recollections of the "good old times" when the "boss" knew every man in the shop by his first name; when there was not the endless number of intermediate authorities and assistants this and assistants that between him and the "hands"; when he was often to be seen prowling about the shop, poking under benches and digging into various places, giving a word of commendation here and of condemnation there and passing the time of day with every one; when he knew every job in the shop from the drafting room through the pattern shop and foundry to the machine shop and shipping room and could do any or all of them himself if necessary. In those days he was not enshrined in a nickel-plated office with every door marked "private" and a brass-buttoned guard at each of them.

CHORDAL STILL APPEALS

For me, Chordal's articles are still fresh, rich and good. I am still looking for anything to equal them in interest; in their quaintness, humor and deep insight into the gray matter of the average machinist. The good old times cannot come back. As someone has so truly said: "The happy care-free days of youth, once spent, are gone forever." Nothing is more sure than change, and the old days would not fit in at all with the present. Old methods are out of date and new ones are often scrapped over night for still newer ones; but the time comes to us all when we enjoy looking back to the early days.

Back in the early "seventies" I was working in a little shop on Hanover Street in Boston where, almost directly under me, Thomas Edison was working for Welsh & Anders, who were building printing telegraphs for short lines; while at the head of the street and just

around the corner of Court Street Alexander Bell was tinkering in Wilcox's electrical shop with an apparatus he called a "telephone." I have been in that little shop many times, and, later, I saw that apparatus—"Bell's toy"—in 1876 at the Centennial Exposition in Philadelphia.

Old Clippings Bring Memories

In moving about from one place to another I could not keep the large number of copies of the *American Machinist* that came to me and so I clipped those articles that interested me, and in these later years I find them still of absorbing interest. I came across one not long ago from one of your correspondents upon the subject of flying. He goes to great lengths to prove how "utterly impossible" it was for men to navigate the air and concluded with a very humorous story descriptive of its uselessness and impracticability.

In 1885 I was working in the Colt's west armory in Hartford, Conn., where I became acquainted with a Mr. William Tibbals, who was then retired from business and spent a good deal of time in his son's sign-painting shop on American Row, directly back of the post office. Mr. Tibbals was a member of the firm of Crittenden & Tibbals of South Coventry, who used to make cartridges before the Civil war and who later sold to Schuyler, Hartley & Graham of Bridgeport, now the Union Metallic Cartridge division of the Remington Arms Company.

Mr. Tibbals was a most interesting talker and I enjoyed many evenings in the sign shop listening to his reminiscences of the early days of the cartridge business. He was well acquainted with "Sam" Colt (that was before the latter attained his title of Colonel) when he was tinkering with his revolver. It seems that Sam was "stuck" for a means to revolve the cylinder, and it was a Hartford watchmaker who suggested the ratchet with a pawl attached to the hammer; the principle that is still in use today.

Muzzle-Loading Revolvers

The early form of revolver had nipples at the rear of each chamber in the cylinder, and the chambers had to be loaded with powder and ball from the front, the same as a muzzle-loading rifle. A small ramrod, hinged beneath the barrel, was provided to force the bullets into the chambers as the cylinder was revolved in the loading process, and each nipple had to be covered with a percussion cap. An improvement was made in the loading by placing the powder and bullet in a greased paper cup, which allowed the two elements to be placed in the chamber and rammed home at once.

One of the workmen in Colt's armory patented a revolver cylinder with holes drilled clear through, thus doing away with the nipple and cap, but the art of cartridge making was not then sufficiently advanced to make it easy to procure ammunition for such an arm. However, Mr. Tibbals was working on the project and in the meantime nothing was done about the patent.

About this time D. B. Wesson, of the Smith & Wesson Pistol Co., located in Springfield, Mass., heard of it and went to this man, from whom he bought the patent for the sum of one thousand dollars. Mr. Wesson told Mr. Tibbals that he did not feel safe without that patent, which was thus taken from under the nose of Colt's, but the matter must have been soon adjusted as not long afterward both firms were making that type of pistol and Mr. Tibbals was supplying the ammunition.

Stability of the Automobile Market

By Alfred Reeves
General Manager, National Automobile Chamber of Commerce

EVERY manufacturer of motor vehicles knows the soundness of the business and the good promise of markets for companies that offer good products at good value, well merchandised.

Every time there is a slowing down in business, every time that production exceeds sales, certain financial writers become alarmed and there is a flood of publicity querying the strength of the industry.

This volume of interest and newspaper comment is in itself a tribute to the stability of the business. It testifies to a wide public use of and interest in motor transportation.

A brief consideration of a few facts will indicate the basic factors that will assure markets for the months immediately on hand as well as for the future.

Economists will readily grant that the market may equal the number of vehicles scrapped; that is, no one expects the total number of cars in use to decline. This will total between 1½ to perhaps 2¼ million vehicles in 1924 and represents the primary replacement market.

Many writers also suggest vast possibilities of sales if a $200 car can be produced. The fact is that the $200 car, in fact the $100 car, and even sometimes the $25 car is already here.

Finding a Market for Old Cars the Real Problem

In studying the market, one should remember that the problem is not mainly how many new cars can be sold to new owners, but how many used cars can be resold and replaced by new vehicles. If for instance there is a market for two or three million used cars at prices ranging from $100 and $200 up, according to the original value of each of the vehicles, these purchases mean a creation of a market of owners who have sold their used cars and are in the market for new vehicles. This process, this secondary replacement market, is a continuous performance with the dealer acting as agent between the new car buyer who is also the used car seller.

There is reasonable expectation that at least 4,000,000 motor vehicles will be sold this year whether production is emphasized primarily in spring or summer or whether it is more generally spread over the whole year. There is always a possibility of business curtailment, in which case motor vehicle manufacture might be reduced. It is worth noting, however, that in no peacetime year has production in this industry been reduced and curtailed more than 25 per cent.

Export Market Is Growing

In addition to these permanent factors, the industry may look forward to the increasing number of exports—which reached 328,000 this year, including foreign assemblies, or 221,000 not including assemblies. The 221,000 figure compares with 116,000 a year ago and with 194,000 in 1920, the highest preceding year.

Further, there is a wider use for motor transportation over here. Finally, this country is growing continually in wealth and population and will register increasing demand for the efficiency and convenience provided by motor transportation.

Ideas from Practical Men

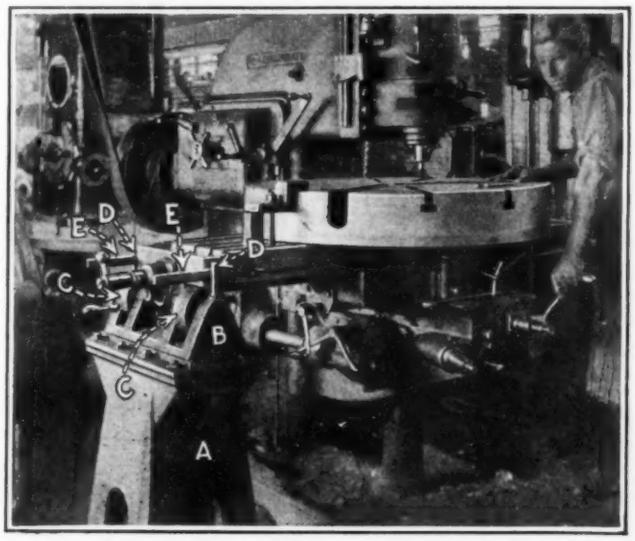
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

An Outboard Support for a Milling Machine Table

BY JACK WILLIAMS

While the knee of a milling machine is admirably adapted to the majority of work the machine is required to do, there are times when it calls loudly for outside assistance; and one such instance is shown in the accompanying illustration, which is from the shops of the Bullard Machine Tool Company.

The machine illustrated is employed in milling the jaw slots in chuck bodies, some of which are of large diameter and weigh many hundreds of pounds. The job demands nearly the full range of traverse of the



Outboard support for a milling machine table

table, and when the latter is run out to its limit in either direction, the overhanging weight is too much to expect the machine to bear with safety. To sustain a part of the weight and relieve the twisting strain upon the knee of the machine, two permanent outboard supports, one of which is shown at *A*, have been rigged up; one at each end of the table.

As the machine is continuously busy upon one type of work and there is never occasion to move the vertical adjustment of the knee, no vertical adjustment of the support was provided.

The slide *B*, carrying two flat-faced rollers *C-C*, is gibbed to move easily across the top of the pedestal in a direction parallel to the in-and-out movement of the machine saddle. The height of the pedestal is so calculated that when the table of the machine is extended, the flat bearing surfaces upon which it slides just meet the rollers and ride over them without deflecting the table, and therefore the rollers sustain their share of the weight from the moment the table enters upon them.

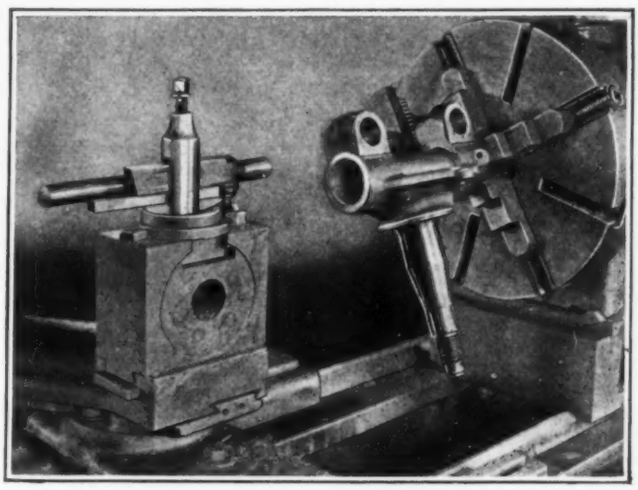
To relieve the operator of the necessity of watching the endwise position of the roller-carrying slide, to prevent the table from coming in violent contact with it should the table happen to be moved sidewise while it was off the rollers, the pins *D-D* project vertically from the roller housings and the wedge-shaped pieces *E-E*, attached to the table, enter between them and move the rollers to the correct position to receive the table just before the latter reaches them.

A leeway of an inch or two either way is thus automatically taken care of and is more than the amount that the saddle is ever moved.

A Combination Toolblock for the Lathe

BY CLIFFORD H. FRENCH

A combination toolblock for use on a LeBlond lathe is shown herewith, the main object being to have as few loose pieces as possible around the lathe. The lathe is shown blocked up to swing the steering knuckle of an



A combination toolblock

American La France truck, and the upper part of the toolblock is used for holding the regular tool post and the boring and threading tool. The block is held in the compound rest by a bolt at each end.

With the lathe head lowered to the bed, the large hole in the toolblock lines up with the spindle and affords a substantial support for boring bars and similar tools. Here is one of the cases where a little rigging up helps production in small quantities. This device is used in the shop of the U. S. Tool Co., Newark, New Jersey.

Demonstrating the Path of a Cutting Tool When Turning a Taper

By George C. Smith

The question as to whether or not a lathe, set for turning a taper, will produce a true taper when the point of the tool is above or below the level of the axis of the piece being turned is one that is often raised in the machine shop. The purpose of this article is to demonstrate the path of the cutting tool in relation to the work under these circumstances and to show not

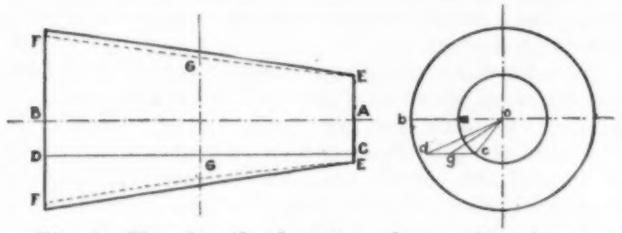


Fig. 1—Showing the departure from a true taper

only that it will not produce a true taper, but *why* it will not.

Referring to Fig. 1, let us assume that the diameters shown therein are the large and small diameters required. If the tool is set on a level with the center it will travel along the path *AB*, while the line *ab* represents the amount the tool has receded from the center during its traverse. If the tool is set below the center so as to travel along the path *CD* and, the amount of recession being the same as before, the outward move-

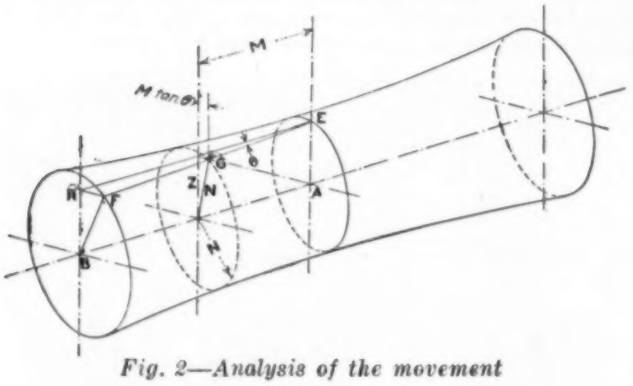


Fig. 2—Analysis of the movement

ment of the tool with relation to the work is represented by the line *cd* on the projected end view.

From points *c* and *d* we strike off the radii *oc* and *od* and transfer them to their respective positions on the side view, getting points *E* and *F* as end positions of the tool, while by transferring other radii from points along the line *cd* and drawing a line through them we find the line of traverse, *EGF* of the tool. The question now

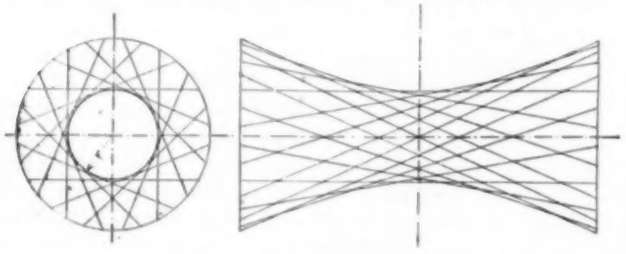


Fig. 3—The hyperboloid of revolution

arises as to the nature of the line *EGF*; whether it is straight or curved.

Referring to Fig. 2, it will be noticed that the plane *RFE* has been passed through the truncated cone parallel to the axis, and that at a distance *M* from *E* a perpendicular is dropped. From this diagram it will be seen that:

$$N^2 = M^2 \tan^2\theta + Z^2$$
$$N^2 - M^2 \tan^2\theta = Z^2$$
$$\frac{N^2}{Z^2} - \frac{M^2 \tan^2\theta}{Z^2} = 1$$
$$\frac{N^2}{Z^2} - \frac{M^2}{Z^2 \cot an^2\theta} = 1$$

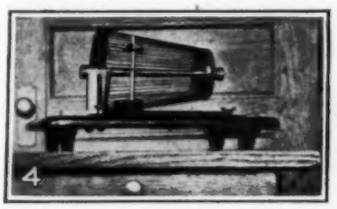
Letting $N = x$, $Z = a$, $M = y$ and $Z \cot an\theta = b$, we have:

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

This equation being that of a hyperbola shows that the point *G*, Fig. 2, or *g*, Fig. 1, is on this line, proving that the line *EGF* of Fig. 1 is a hyperbola.

By comparing the diagram Fig. 2 with that of Fig. 3 it will be seen that Fig. 2 has the properties of the well-known warped surface of revolution, called the hyperboloid of revolution. The radius *EA* of Fig. 2 is the radius *r* of Fig. 3, and is called the radius of the gorge circle.

A home-made model used for the purpose of demonstrating the result of setting a lathe tool off center when



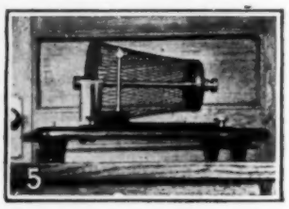


Fig. 4—Model for demonstration. Fig. 5—The model with the strings crossed

turning a taper is shown in Figs. 4 and 5. It consists of a base to which is affixed an upright carrying a hollow horizontal shaft. Concentric with the shaft and fixed to the upright is a disk of large diameter, having short pins placed radially and equidistantly around the periphery. At the opposite end of the shaft is a sliding bushing carrying two smaller disks, which are also provided with radial pins corresponding to those in the large disk.

Each of the smaller disks is counterbored upon the face adjacent to its mate and at the bottom of each counterbore radial teeth are milled, forming a face, or crown, gear. Between the two gears and within the recess formed by the counterbores is a small pinion, turning upon a stud that is fixed to the carrying bushing so that as one disk is revolved the mating disk is also revolved an equal amount in the opposite direction.

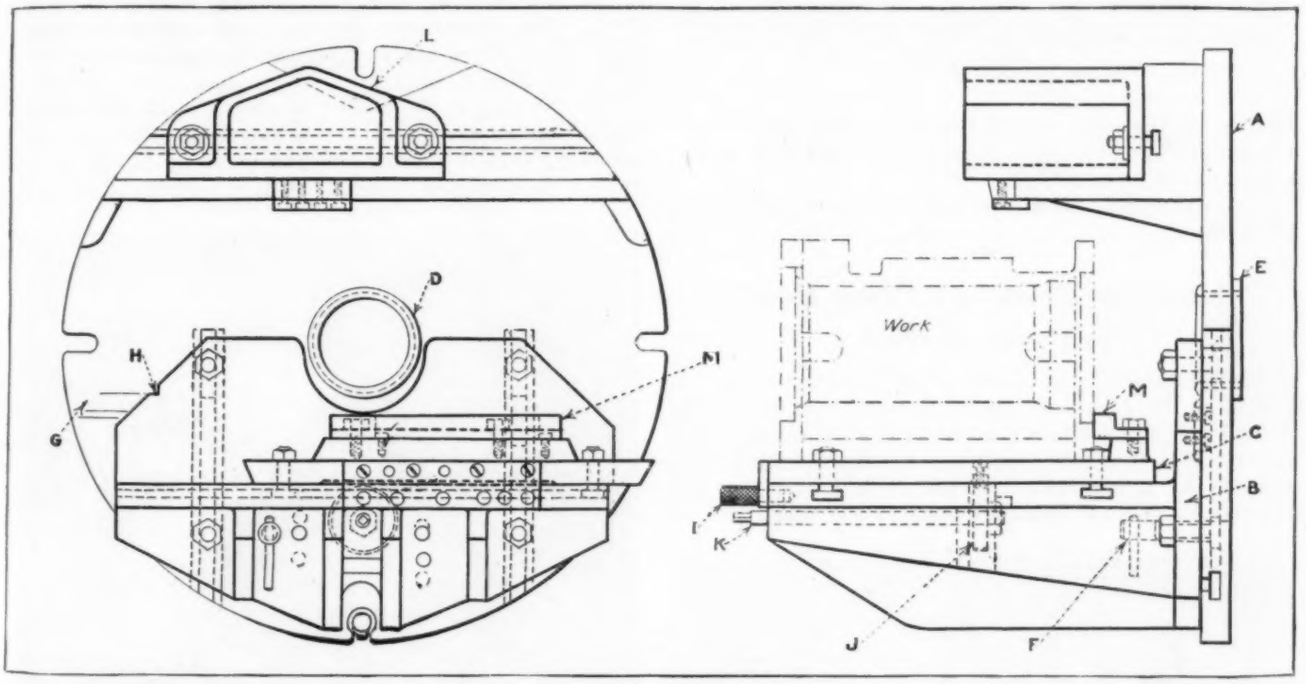
Fish-lines are strung from the pins of one small disk to the pins of the large disk and back to the pins of the other small disk. The lines are all strung under the same tension and are kept taut by a spring within the hollow shaft that presses against the sliding bushing. Mounted upon the base is a dovetailed slide and block carrying an upright and pointer. The pointer represents the lathe tool and can be adjusted for height with relation to the center of the shaft and thus made to follow any line parallel with the base along the entire length of the hyperboloid.

Figure 5 shows the model with lines crossed, caused by giving the small disks a slight turn, and is comparable with the diagram, Fig. 3, showing the amount of departure from a straight line. The result is the same whether the tool is set above center or below it.

Cylinder Boring Fixture for Gisholt Lathe

By O. Kampschaefer

The boring of single and double steam-engine cylinders in our shop was formerly done on two horizontal boring machines, one of which was equipped with a double boring rigging for boring both cylinders of a pair at the same time. An investigation showed that the time of these machines was occupied to such an extent in cylinder boring that they were seldom available for other important work. This same investigation also showed that a 36-in. Gisholt lathe was short of scheduled work, so it was decided to transfer the cylinder boring operations to the Gisholt machine, relieving the load on the boring machines and making it possible to increase the productivity of the shop with the machine equipment already at hand.



Cylinder boring fixture

For boring the cylinders on the Gisholt lathe, it was, of course, necessary to provide a fixture to hold the work on the faceplate. Because of the variations in size and design of the cylinders, the fixture required almost universal adjustment features. The bores of the cylinders vary from 4½ to 8 in. in diameter, with lengths from 9 to 15 in. and various counterbores. As mentioned before, the cylinders are cast both single and in pairs, the distance between the centers of bores of the double cylinders being varied, as well as the distance from the center of the bore to the steam chest flange-face.

The fixture shown in the accompanying illustration has handled this work in a most satisfactory manner. It consists essentially of an auxiliary faceplate *A* to the face of which is bolted an angle plate *B* carrying a work table *C*. The angle plate is adjustable vertically on the faceplate, being guided by keys in the faceplate slots and held in position by four bolts. The bushing *D* is located at the center of the faceplate to guide the boring bar, and the pilot boss *E* centers the fixture on the faceplate of the machine.

The angle plate is located at the desired distance from the center by means of the pin *F* which enters locating holes in the faceplate. A visible check of the setting is made by means of the indicating lines *G* which register with the notch *H* in the angle plate. Each line is stamped with the pattern mark for the cylinder to which it corresponds.

The work table *C* can be moved sideways on the angle plate to accommodate double cylinders, and is guided by keys in the T-slots of the plate. The required positions of the table are fixed by means of an index plate and pin *I*, the index plate being attached to the table. The table is traversed by a gear and rack *J* operated by means of a crank on the projecting shaft *K*. A counterweight *L* is attached to the fixture diametrically opposite the angle plate, and can be shifted to counterbalance the overhanging weight of the cylinders.

To insure the squareness of the bore with the head flanges, the cylinder is located against the block *M*, the location of the casting across the fixture being determined by the cores. Boring bars equipped with Davis adjustable tools are used, one for roughing and the other for finishing. The tools and bars were finally arranged so that only two sets of bars are used to bore the six different cylinders, a change in the turret of the lathe and the use of compound pilot bushings of various lengths, being necessary.

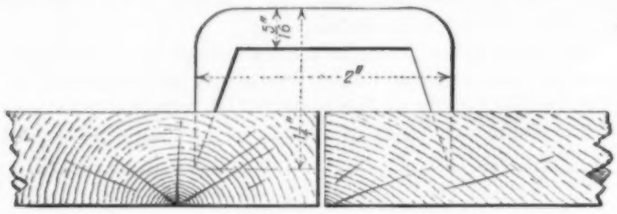
This fixture was a time-saver in direct labor hours, and also helped to balance the available machine-tool hours. An increased number of cylinders was machined in a given period without holding up the work on kindred parts, and the expenditure for the fixture was justified.

Patternmakers' Dogs

By R. E. Thomas

Dogs used by patternmakers to hold two pieces of wood together, to work upon them or to hold them in place until they are glued, can be made from spikes or nails of different sizes, depending on the size of dog desired.

We bend a spike to the sizes as per sketch, making a right angle on both ends, place it under the power hammer or on the anvil and flatten it to $\frac{1}{16}$ of an inch in thickness. We next place it in a vise and file it on the inside to the proper angle.



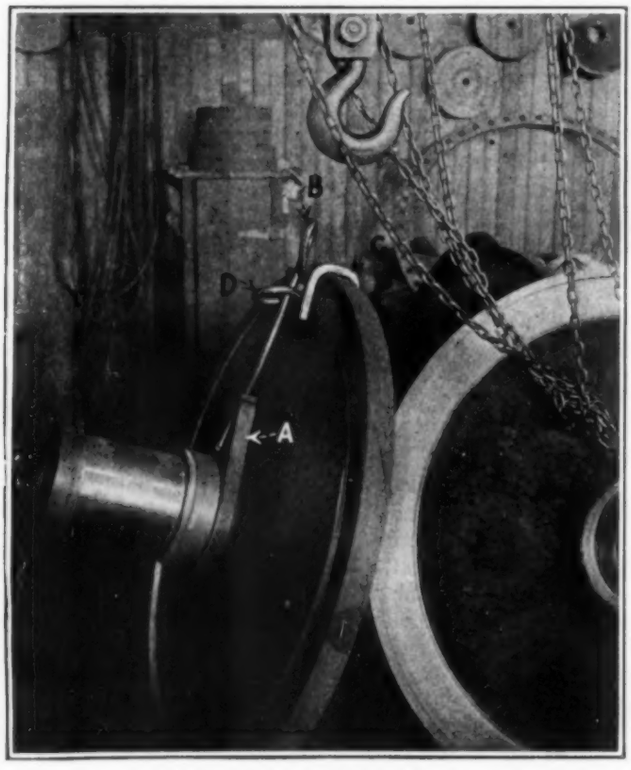
Dog for patternmakers

This will make a good dog and hold the work tight at all times.

Sling for Hoisting a Drum Head

By Charles F. Henry

Among the products of the Asher Manufacturing Co., Irvington, N. J., are drums for ironing machines. The drum heads are a bit awkard to handle as well as being heavy, so a sling has been made as shown. This sling consists of a loop or strap *A*, with a rod running through it, the rod having a loop in the upper end as at *B*. At *C* is a clamp which fastens over the edge of the drum head. Fastened to the clam is a loop, *D*, which surrounds the lifting rod *B*.



A sling for a drum head

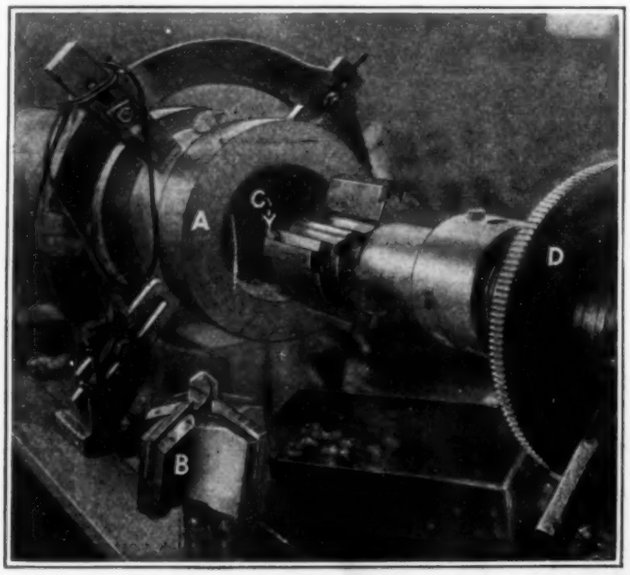
The combination of strap and clamp prevents the drum head from either turning or slipping when it is being handled by the chain hoist. It is a simple device and can be modified to suit many pieces of awkward shape.

Deep Hole Drilling in Hydraulic Jack and Press Work

By R. E. Marks

The making of hydraulic jacks and other apparatus, especially hydraulic presses for fairly long stroke, requires considerable deep hole drilling, with good sized drills. The illustration gives a good example of such work and is from the shop of the Watson-Stillman Co., Garwood, New Jersey.

The forging to be drilled is shown at *A*, the outer end being supported in the steadyrest. The first, or roughing drill is shown at *B* and is 9¼ in. in diameter. It is a built-up cutter head, having a center drill and four blades supported in a substantial holder. The cutting edges are notched to break up the chips. The work runs 15 r.p.m., and the drill advances about 4½ in. per hour.



Boring tools for deep holes

The hole is finished with the reamer shown in the boring spindle. The reamer is 10½ in. in diameter and cuts $\frac{5}{8}$ in. on each side. The reamer blades carry cutting tools at the front ends, as can be seen at *C*. The tools have plenty of top rake and cut easily. The reamer blades finish the hole to size. The hole in the case shown, is 9 ft. 10 in. deep.

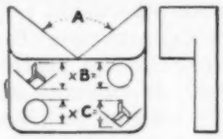
The drill and reamer are mounted on a long spindle having a thread cut on the outside. The spindle is moved by means of the large wheel *D*, having ratchet teeth on the outside and an internal thread in the hub. The pawl and lever which operate it are on the other side, and consequently could not be shown in the illustration.

V-Blocks for Measuring Odd-Toothed Cutters

By G. B. Olson

The diameter of cutters having an odd number of teeth, can easily be measured by the use of a micrometer and the V-blocks as shown in the sketch.

The one for five-fluted cutters was described on page 227, Vol. 59, of the *American Machinist*, but is again



No. of Flutes	Angle A	Constant B	Constant C
3 or 9	60°	0.6666	1.5
5	108°	0.8944	1.118
7	128°34'17"	0.9479	1.0549
11	147°16'22"	0.9793	1.0211

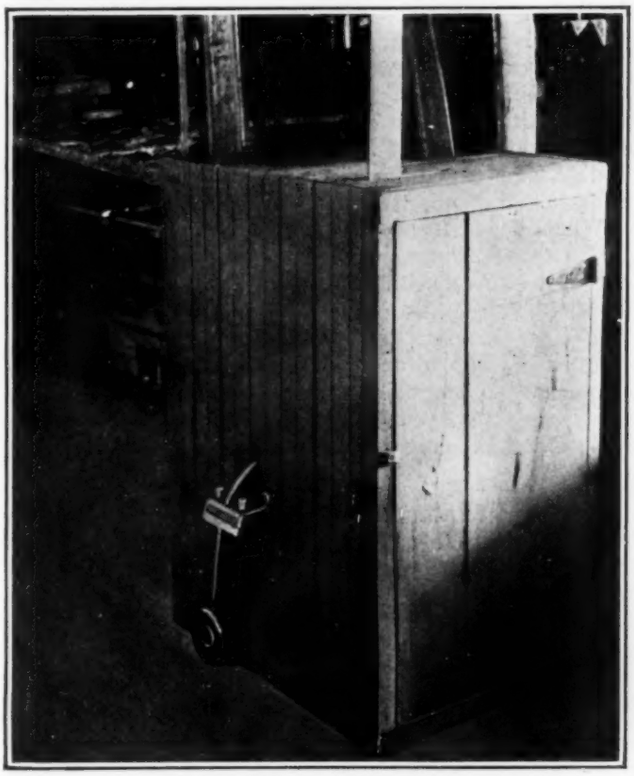
V-Block for measuring cutters with odd numbers of teeth

included in the table to make the list more complete. The two lines of the angle must intersect the horizontal line, and when made this way, a 1-in. plug placed in the V, should show the same micrometer reading as given for the constant *C*.

A Guard for Planer Belts

By Donald A. Hampson

The photograph shows a better-than-usual guard for planer belts. In appearance the guard is neat and harmonious, and its effectiveness could not be improved upon. It is constructed of wood and has bracings of metal inside. A full size door at one end provides entrance for oiling and inspection. Slots in the top permit the belts to shift from tight to loose pulleys, and the edges of the wood are rounded to avoid belt wear in cas the stretch allows the belts to slap.



Guard for planer belts

It is customary to guard such belts by a pipe railing, which must be set at some distance from the belt to satisfy regulations, or to install wire mesh on some sort of a framework. The unfavorable argument toward the above includes the waste space occupied by railings, and their actual hazard; while the mesh guard is frail and too often unsightly. In favor of these devices there are advanced the open lighting and the ease with which the floor may be kept clean.

The tight wooden guard shown permits greater cleanliness, because its edges are out where no reaching under with a broom is required and they are flush with the floor. Where there is a pulley pit, as in this case, trash and miscellaneous articles cannot be swept into the pit. So far as lighting is concerned, a wall four or five feet high, shuts off no light from machining operations of any sort. With belts traveling about a mile a minute, the confidence inspired by a guard of this type makes for better service.

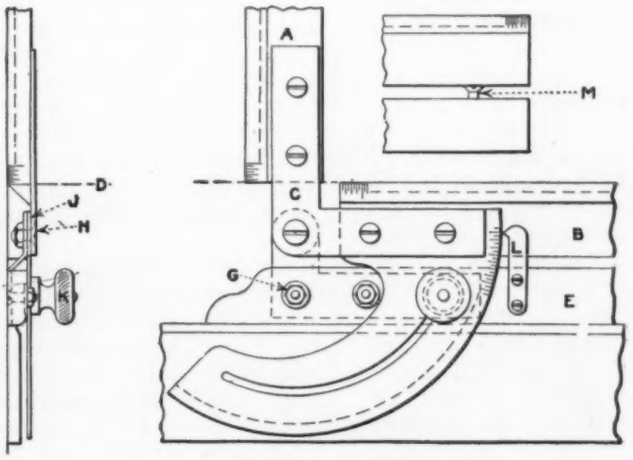
A Home-Made Drafting Tool

By E. E. Lasko

The illustration shown herewith is of a drafting tool that has proved so convenient to me that I want others to know of it.

The construction of the tool is as follows:

Two draftsman's scales *A* and *B*, 12 and 18 in. long, respectively, are fastened at right angles to the corner iron *C*, in such position that the lower end of *A* is in



A useful drafting tool

line with the top edge of *B*, as indicated by the line *D*. Part of another corner iron is set flush into the under side of the straightedge *E*, being attached thereto by bolts as at *G*, and bent as shown in the end view. The two corner irons are pivoted by the bolt *H*, a fiber washer being placed between them at *J*.

The protractor is cut from one of steel or celluloid, to the shape shown, and provided with a circular slot, so it may be clamped in any position by the bolt and knurled nut *K*. To the straightedge, is fastened the pointer *L*, and at the extreme end of the straightedge is placed the adjusting screw *M*, for setting scale *B* parallel thereto.

The tool is used in the same manner as the ordinary draftsman's triangle, and need be used but once to demonstrate its advantages.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Ordnance Department Adopts Unilateral Tolerance

THE increasing use of unilateral tolerances has been very gratifying to those of us who are convinced that this method has many advantages in practical and economical manufacturing. Now the Small Arms Division of the Ordnance Department has decided to transfer all of the small arms drawings into the unilateral system and to establish more liberal tolerances where possible. This decision comes as the result of careful study on the part of Ordnance officers and a number of drawings have already been prepared in accordance with the new system.

Another striking and important change in Ordnance practice is the increase in tolerances wherever it can be done without interfering with the proper functioning of arms or their practical interchangeability with arms already in use. This has been brought about largely, we are informed, by the comments of civilian manufacturers who have been approached in connection with the allocation of war orders to the districts. Many cases have been found of close tolerances on non-fitting parts.

The experience gained in the last war due to the necessity of carrying out the large manufacturing programs necessary at that time, is now being capitalized in a very practical way. The Ordnance Department is endeavoring to profit by this experience and is making its drawings conform as closely as possible to standard commercial practice. It will consequently be much easier to secure rapid and economical production in cases of emergency and the delay and confusion of 1917-18 can be largely eliminated.

The country is to be congratulated on having a staff of Ordnance officers who are far sighted enough to see the necessity for such action, and with initiative enough to put it into practice in time of peace when re-adjustments can be made with comparative ease. Both the unilateral method and more liberal tolerances are strides in the right direction and cannot fail to be reflected in the securing of work more promptly and at lower costs.

The Round-the-World Flight

THERE seems to be some misunderstanding regarding the round-the-world flight by the four army planes, which is now in progress. This flight is not a race in any sense of the word, but a carefully organized plan for proving, if it can be proved at this time, whether there is a practicable air route around the world. It would, of course, be much more spectacular if the planes had gone on as fast as possible, had taken chances with the weather and been much farther along on their journey. But the likelihood of success resulting from such a course would have been very small and we should probably have condemned it as foolhardy.

Every precaution is being taken to make the trip of real value to the world by following safe and sane, rather than dare-devil, methods. When it is over we shall have a vast amount of knowledge regarding engine performance in actual flying and know a lot more about wing surfaces, landing apparatus and flying conditions in out-of-the-way places.

Those who get impatient at the slow progress to date and the time spent in grooming and conditioning these planes, should recall the famous round-the-world trip of a few automobiles, something over 15 years ago. The automobile had not reached its present state of perfection and cars were repaired and rebuilt as necessity demanded. And just as the automobile has won its place as an established mode of transportation, so will the airplane fill its niche in less time than we realize.

Wonder What a Congressman Thinks About

WE HAVE been waiting for some days to see if Mr. Briggs, the cartoonist, would revive his famous series to include the above title. As he has not done so we are tempted to do a little wondering of our own.

Within the last few days three of the most prominent men in this country have paid their respects to Congress in no uncertain terms. They are President Coolidge, Senator Borah and Judge Gary. If we may attempt a combined summary of the remarks of all three gentlemen it is that both branches of the national legislature have been singularly remiss in acting for the best interests of the country. There is no need to be specific, every citizen who reads the daily papers knows the details.

Judge Gary made it plain that he was talking about Congress as a body and that he had no particular individuals in mind. Assuming, for the moment, that we all have the same detached point of view, how in the world can a member of either House or Senate escape the conviction that he has lost the confidence of his constituents? In every test between Congress and the President, Mr. Coolidge has emerged with credit and stronger support from the people—and Congress has done just the opposite.

What does a congressman think about, anyway? If he thinks about anything, and some people go so far as to question his ability to think at all, it must be about votes. As a matter of fact people don't send a man to Congress to think about nothing but votes, they expect him to do something constructive. And if he spends all his time laying plans for obtaining the necessary votes to get back for another term he is likely to find that the voters have no further use for him.

Considerable attention is being paid to the desertion of the machine industry by American boys and their replacement by foreign born citizens. The situation is a serious one but there is ground for optimism. In the personal column of this magazine a week or two ago it was authoritatively announced that John Milton and Miles Standish are actively interested in the machine industry. Evidently some of the good old Anglo-Saxon stock are still in the game.

Shop Equipment News

Bullard 10-In., 6-Spindle "Contin-u-matic"

The Bullard Machine Tool Co., Bridgeport, Conn., has recently brought out another model of its continuous turning and facing machine, similar in principle to the "Contin-u-matic" machine described on page 936, Vol. 57 of the *American Machinist*, but with six spindles instead of four. It embodies the same simplicity of construction and other characteristics of the older machine, together with several recently developed features. It is particularly adapted to the machining of small round pieces that can be held in chucks or special fixtures, and while somewhat more restricted in range of sizes that can be handled than its predecessor because of the added spindles, it has a correspondingly increased productive capacity. The machine shown in the illustrations herewith is set up for turning, facing and grooving the pistons of automotive engines, the class of work for which it is especially suited.

The machine is constructed upon the unit assembly plan and, up to the point of adding the cams and tool-slides, is standard for any round work 10 in. or smaller in diameter and not over 14 in. long. Like most automatic machines it requires cams especially designed to suit the particular work in hand, and sometimes a slight modification of the tool-slides is desirable in order to obtain maximum production. Therefore, the machines are standard up to this point, and the cams and tool-slides are added in accordance with the specifications of the job for which each machine is intended.

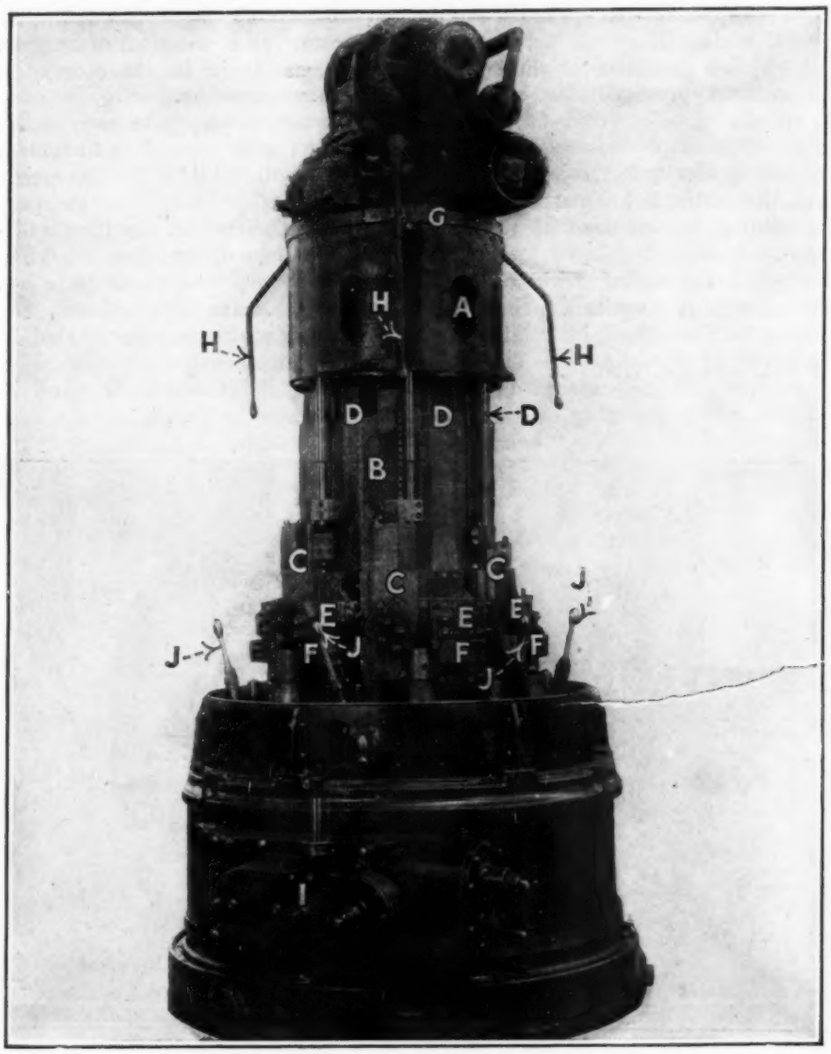


Fig. 1—Bullard 10-In. 6-Spindle "Contin-u-matic"

Each spindle and its corresponding tool-slides is a complete unit in which any combined turning and facing operation may be accomplished independently of the remaining units. Simple parts that require but one chucking and one set-up of tools are delivered completely finished at the rate of six for each full cycle of the machine. Of pieces that require two sets of tooling and two chuckings, three are delivered; while if a piece of work is so complicated as to demand three separate handlings, two are taken off at each cycle.

When one set-up is sufficient to finish the work upon a given piece the six units are tooled alike and have the same movements. On a two-operation part alternate units are tooled for the first operation and the intervening units for the second. For a three-operation piece, units 1, 2 and 3 would be tooled for the successive operations, units 4, 5 and 6 being arranged in the same manner.

The central column of the machine is stationary and the upper part of this column, under the protective casing *A*, Fig. 1, is encircled by the main cam, which is bolted to the column and has no movement. From this cam all tool movements are primarily derived. When the machine is in operation the carrier *B*, with all work spindles, tool-slides and attached parts, is in slow but continuous rotation about the column.

The contour of the main cam determines the amplitude and nature of the movements of all tool-slides

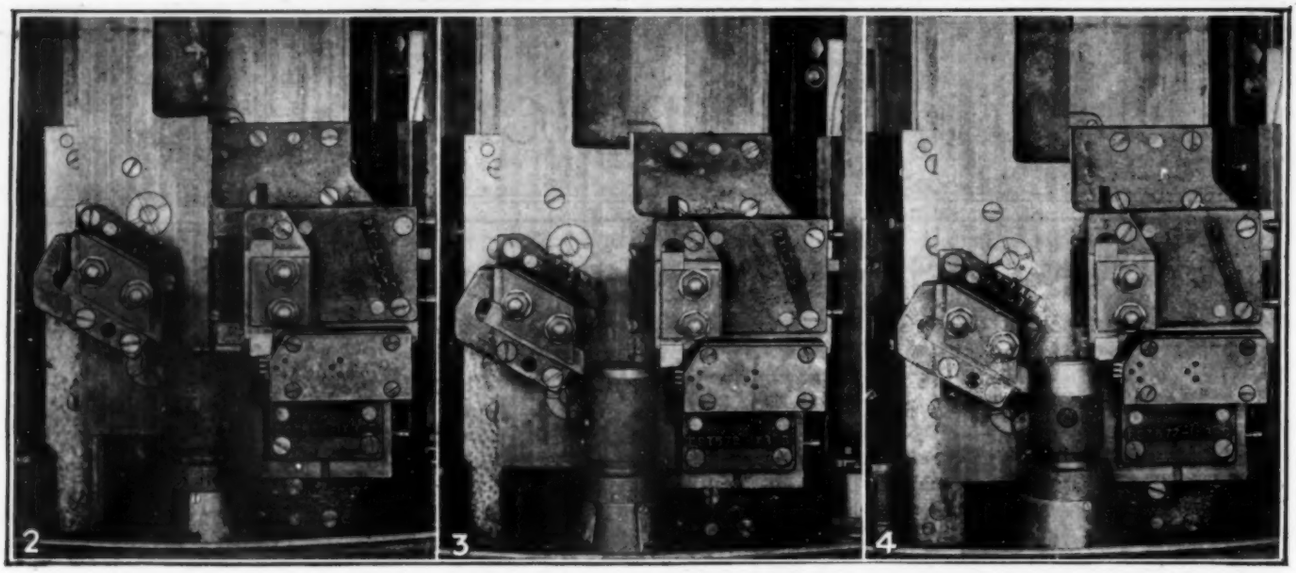


Fig. 2—Loading sector with casting in chuck. Fig. 3—Second sector, turning begun. Fig. 4—Third sector, facing begun

as well as the relative time of their operation. Each main slide *C* is rigidly connected by the rod *D* to its operating roller, which travels in the groove of the stationary cam as the carrier revolves. Auxiliary cams, attached to the back of the main, or vertical slide, control the movements of the cross-slides *E* and *F*, both as to amplitude and relation.

A 15-hp. motor is mounted at the top of the column and drives the machine through a friction clutch that is engaged and disengaged by the movement of the band *G*. This band encircles the column and is moved by any one of the three hand-levers *H* so that the machine is under control of the operator from several positions.

A change gear box at the top of the column provides for a range of spindle speeds from 35 to 350 r.p.m. The slow movement of the carrier is derived from a central shaft that extends downward through the column to the base of the machine. A second change-gear train located in the casing *I* at the base of the machine permits the changing of the carrier speed in relation to the speed of the spindles. The rate of rotation of the carrier, in combination with the rise of the stationary main cam, determines the rate of feed of the tools relative to the work, and the last-mentioned change-gear train is, therefore, the feed-change gearing.

The crank-handle to be seen at the top of the gear case *I* is an emergency control, and by it the movement of the carrier may be stopped, started or reversed at any time without shutting down the machine. Under ordinary conditions it is not necessary to use this control, for when the machine is once started, it remains in continuous operation until the lot of work in hand is completed.

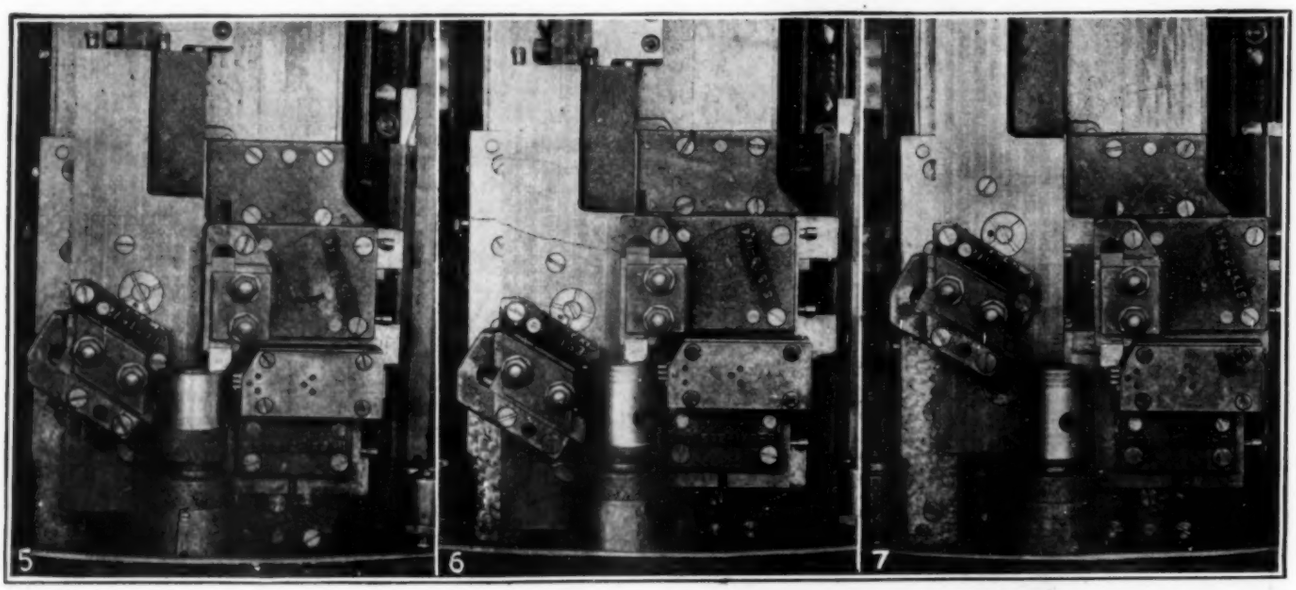


Fig. 5—Fourth sector, turning and facing nearly completed. Fig. 6—Fifth sector, grooving begun. Fig. 7—Sixth sector, all operations completed

The operating position is immediately to the left of this lever and a sector of the circle including an angle of 60 deg. is called the loading sector. As each unit in turn enters this sector the rotation of the spindle is automatically stopped and the grip of the chuck released. The operator then takes out the finished piece, and replaces it with a new casting or forging. As the spindle leaves the idle sector, the work is gripped by the chuck and the spindle again revolves.

The power chucking device, which will be made the subject of a later article, can be controlled by means of the hand levers *J* but is entirely mechanical in its operation. The power necessary to grip the work is applied through gearing in the base of the machine and not by the operator. The hand levers are simply controls by means of which the operator may indicate when and in which direction the power is to be applied. By a very ingenious mechanism incorporated in the device the amount of power applied is only that amount necessary to secure the work firmly without overstraining the chuck, and bears no relation to the amount of manual effort expended upon the operating lever.

As the loaded spindle passes out of the idle sector it is set in motion by a friction device that starts the rotation and accelerates it to working speed. A positive clutch then drops into engagement and continues to drive the work until the spindle again enters the idle sector, after having completed a circuit around the column. All of these movements are automatic and in no way dependent upon the operator, whose sole duty is to unload and load the chucks as they traverse the idle sector.

The power chucking device works with sufficient rapidity so that the operator has ample time to perform the operations of unloading and reloading while the spindle is stationary. His time is conserved by the automatic operation of the chuck since he is not required to pay attention to the gripping of the blank.

As the main tool slide descends to start the longitudinal turning cut, the auxiliary cams at the back of the slide bring forward the cross-slides *E* and *F* at a rate depending upon the angular position of the respective cams. The contours of all cams are calculated to finish all feeds and withdraw the respective slides as the work spindle enters the idle sector.

The illustrations from Fig. 2 to Fig. 7 show the successive positions of the tools at the various sectors about the machine. In the particular job illustrated the cycle time is 1 min. 54 sec., and since the pieces are finished in one operation, all six set-ups being alike, the individual operation time is 19 seconds, including the loading. If two set-ups were required to finish the piece the operation time would be 38 seconds, and a three-operation piece would require 57 seconds.

The actual machining time is, of course, approximately five-sixths of the cycle time, but the machine delivers a finished part every 19 seconds, when on the job illustrated. The illustrations from Fig. 2 to Fig. 7 give a clear idea of the action of the turning and facing tools. It might be mentioned that the same casting does not appear in all the figures, since the photographs of the sectors were made with the machine stopped and all chucks loaded.

The machine is of massive, rigid construction throughout and weighs 20,080 lb. without the tooling equipment. The diameter of the base is 67 inches and a minimum floor space of about 8x8 ft. is necessary to provide room for the operator to handle the work. The shape of the carrier below the chucks is such that the chips are swept off by the rotative movement and pass out through an opening in the guard to a chip-box.

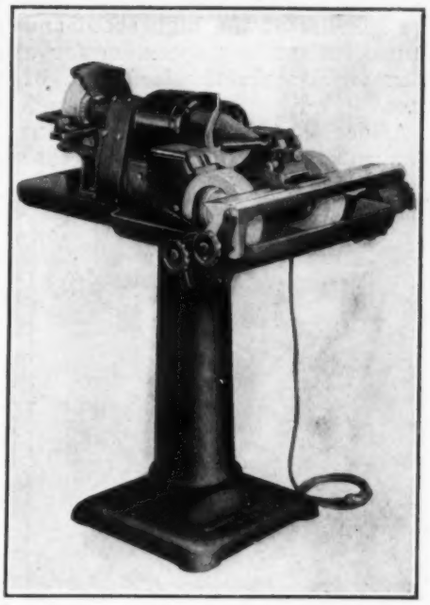
All tool-slides are counterweighted so that the cam, though positive in its action in either direction, is relieved of the duty of lifting them on their return movements. The base of the machine is a reservoir for lubricating oil, the oil being pumped to the top of the column and delivered through suitable tubes to all bearings and gears. Important gears are of alloy steel and all gears are constantly in mesh.

Mummert-Dixon No. 475 Oilstone Tool Grinder

A recent addition to the equipment manufactured by the Mummert-Dixon Co., Hanover, Pa., for sharpening wood-working tools, consists of the No. 475 oilstone grinder. This machine has a coarse oilstone wheel, a fine oilstone wheel, a grinding cone, an emery wheel, and a leather-faced stropping wheel.

The grinding units are mounted in an oil pan attached to a suitable pedestal and all wheels are accessible from two adjacent sides of the machine. All shafts are mounted in ball bearings. The emery wheel is mounted on a shaft driven direct from the motor through a flexible coupling, and is shown at the left in the accompanying illustration. This wheel is provided with a suitable guard and an adjustable tool rest.

At the other end of the motor shaft are mounted the leather stropping wheel and the grinding cone. The leather wheel has a guard so that the tool cannot be applied to the wrong side of the wheel and the cone is also suitably guarded. The motor shaft runs at 1,800 r.p.m., the emery wheel, the stropping wheel and the grinding cone rotating at the same speed.



Mummert-Dixon No. 475 Oilstone Tool Grinder

The shaft that carries the two oilstone wheels is geared to the motor shaft and runs at 600 r.p.m. The wheels are cup-shaped and kerosene oil is supplied to their inner surfaces through pipes from reservoirs located back of the wheels. The oil is forced through the wheels by centrifugal force, an arrangement being provided to prevent the excess of oil being thrown off.

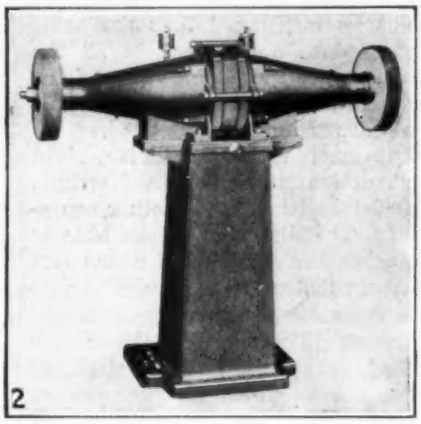
An adjustable slide table extends across the machine in front of the oilstone wheels and may be tilted to any desired angle. This table carries a sliding tool holder for holding chisels, plane bits, etc. The electric switch is located below the motor, which is furnished to suit the available electric current. An extension cable with an attachment plug for connecting the motor to any convenient light socket is supplied.

Cleveland High-Speed Heavy-Duty Polishing Machines

The Cleveland Armature Works, Inc., 4732 St. Clair Ave., Cleveland, Ohio, has recently placed on the market two sizes of high-speed, heavy-duty polishing machines. These machines are motor-driven and are designed to perform polishing operations on a rapid production basis. The wheels run at a speed of 3,600 r.p.m., and the machines have construction features that properly hold the spindles at the high speed and insure satisfactory operation for a commercially practicable length of time.

After considerable experiment Timken tapered adjustable roller bearings, specially mounted in heavy steel containers, were chosen for the spindle mounting. The containers are carried in heavy cast-iron bearing housings.

1



2

Fig. 1—Cleveland Two-Bearing High-Speed Polishing Machine. Fig. 2—Cleveland four-bearing machine for large work

The machine illustrated in Fig. 1 is especially adapted for ordinary work and is built in sizes from 4 to 10 hp. The spindle is mounted in two Timken bearings and its maximum length is 52 in., the height of the spindle center above the floor being 37 in. The motor operates at 3,600 r.p.m. on 3-phase, 60-cycle, alternating current.

For larger and heavier work, such as automobile fenders, bumpers, radiators, etc., the machine shown in Fig. 2 is furnished. The motor capacity of these machines ranges from 5 to 15 hp. The length of the spindle is from 60 to 67 in., and it is carried in four Timken bearings. It has been found of advantage to perform operations on this class of work on the bottom rather than the front of the wheel and, for this reason, the height of the spindle center is made unusually high. The height ranges from 40 to 50 in., depending on the requirements.

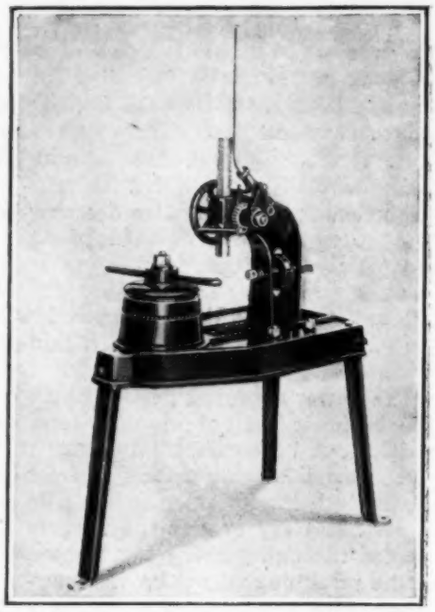
The machine provides ample clearance for handling large work and the surface polishing speed is about 13,000 ft. per min., so that a large amount of this bulky work can be quickly done. It is said that high-speed polishing on thin sheet metal allows rapid cutting with a light pressure, the danger of cutting through thin spots being reduced and the speed of movement of the work across the wheel being increased.

In order to provide sufficient stability at the high speed, the frames of the machines are made heavy and the bases are filled with concrete. The heavy machine shown in Fig. 2 weighs 1,200 pounds.

Prossen Disk Wheel Straightening Machine

The Nilson-Miller Corp., Hoboken, N. J., is now manufacturing and marketing the Prossen disk wheel straightening machine. The machine is designed for straightening disk wheels that have been bent in service and is especially adapted for use in garages and repair shops.

A turret for holding the wheel is supported on a base, as shown in the accompanying illustration, and has a heavy central stud to center a flanged sleeve on which the wheel hub fits. The wheel is fastened to the sleeve by means of a large wing nut, the lower flange resting on a ball bearing so that the wheel can be easily revolved.

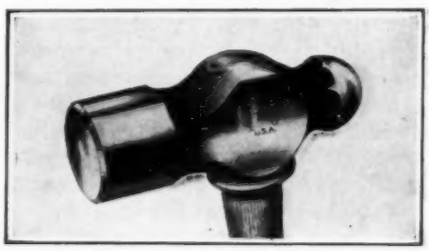


Prossen Disk Wheel Straightening Machine

The frame of the machine guides a vertical ram, operated like the ram of an ordinary arbor press and fitted with an automatic brake to lessen the rebound when the pressure is released. A horizontal jack is also provided for straightening a damaged rim. The frame is clamped to the base and can be moved in or out by loosening two nuts. It is stated that in most cases the wheel can be straightened without removing the tire.

Heller Shock Absorber Hammer

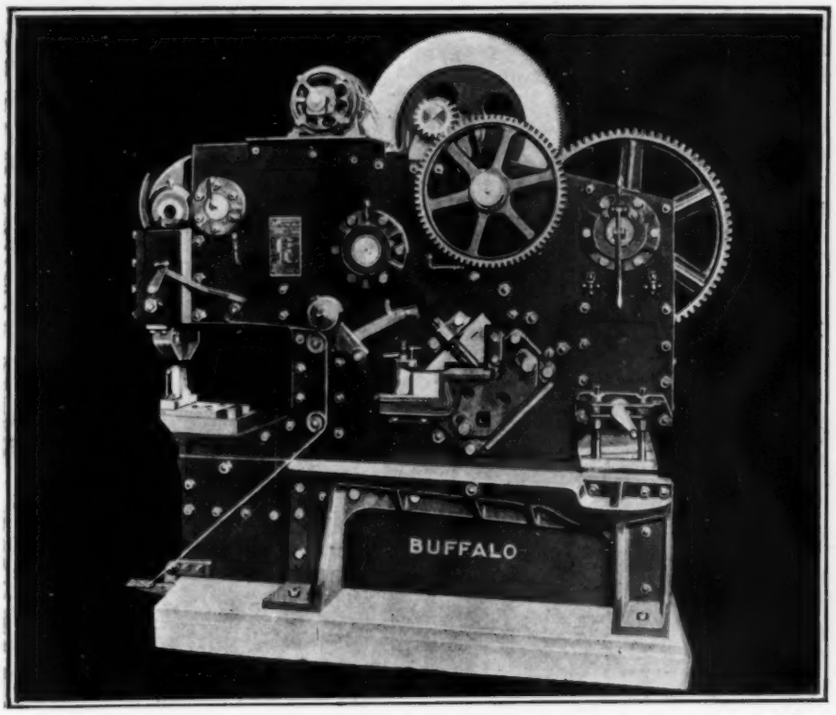
A machinist's hammer, in which a rubber cushion or bushing is inserted between the handle and the head, is now being marketed by the Heller Brothers Co., Newark, N. J. The hammer is shown in the accompanying illustration. The rubber cushion is said to absorb much of the shock of the hammer blow.



Heller Shock Absorber Hammer

Buffalo Improved Shear, Punch and Bar Cutter

A number of improvements have recently been made by the Buffalo Forge Co., 490 Broadway, Buffalo, N. Y., in its line of combination punch, shear and bar cutters. All the machines have been redesigned to some extent, but the essential features remain as described on page 152, Vol. 56, of the *American Machinist*.



Buffalo Improved Shear, Punch and Bar Cutter

The mitering arrangement has been improved by providing a stripper screw that is universal and requires no adjustment. The former arrangement necessitated the removal of the stripper screw for each different angle of cutting desired. Angles can be mitered or beveled on a horizontal plane since the diagonal cutter arrangement is now furnished on all machines. Without this feature, considerable lifting and twisting of the work would be necessary to get it in proper position for the cut.

The three large cast-iron main gears furnished on former machines have been displaced by steel gears, and nickel-steel pinions are used. The gears are considerably smaller without any reduction in strength. The side bracket used for supporting the plates when a slitting operation is under way has been improved by casting the bracket and its supporting legs in one piece. The gear shear clutch, that was formerly located on the gear side of the machine is now on the operating side of the machine where it is more convenient for the operator.

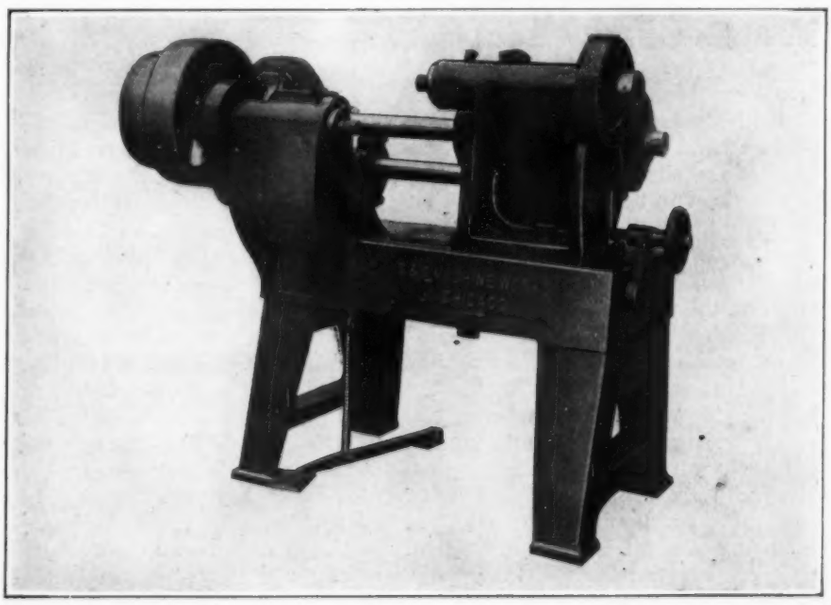
Two dieblocks, two punch holders, two punches and one straight and one bevel die are regular equipment with each machine. The punching capacities are from 1 x ½ to 1¾ x 1½ in., and the plate shearing capacities range from ½ to 1½ inches.

S & S Beading, Curling and Trimming Machine

The No. 4, heavy-duty, beading, curling and trimming machine shown in the accompanying illustration has recently been placed on the market by the S & S Machine Works, 4522 Lexington St., Chicago, Ill. This machine is designed to bead and trim brass shells up to 10 in. in diameter and ⅛ in. thick.

The machine is heavily constructed throughout. The spindles are 2¼ in. in diameter and run continuously. The operator places the work in the chuck and depresses a pedal that operates the clutch on the rear shaft. A cam mounted on this shaft automatically swings the arm that carries the trimming and beading roll and brings the roll into contact with the work. The necessary pressure is gradually applied and the arm moves back automatically when the operation is completed. The rear shaft then stops.

An adjustment is provided in order to set the machine for different diameters of work, the adjustment being simple and the setting quickly accomplished. A two-step cone pulley is used to obtain a change in speed when desired. Among the parts for which this machine is adapted are automobile hub caps, radiator caps, and pieces of a similar nature. The main driving shaft is 2¼ in. in diameter and is geared to the pulley shaft, all gears being suitably guarded. The two-step cone pulley is of the proper width to accommodate a 4-in. belt.

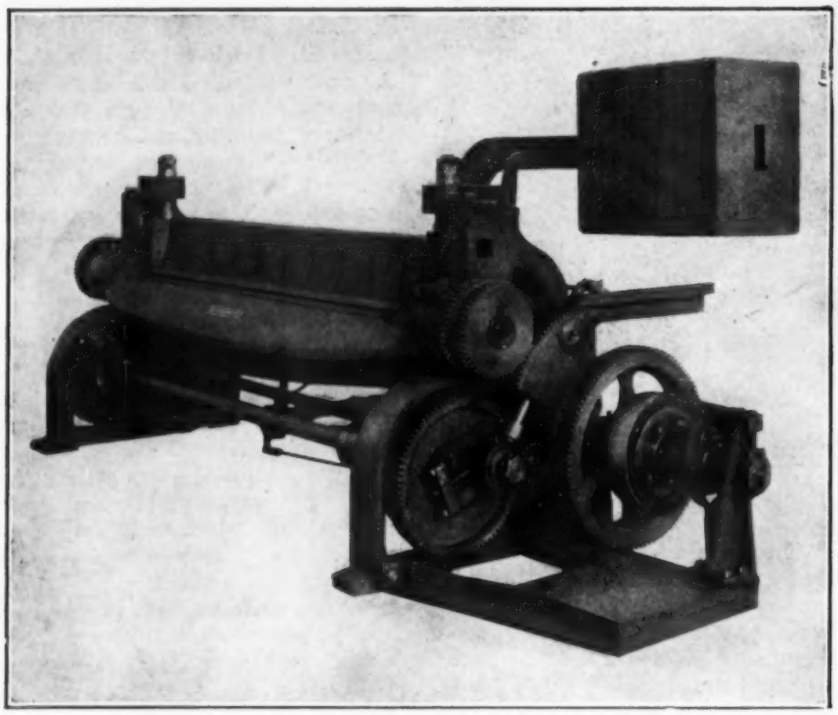


S & S Beading, Curling, and Trimming Machine

Niagara 72-In. Power Folder and Brake

The Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y., has recently added to its line of equipment for sheet metal work the 72-in. power folder and brake shown in the accompanying illustration. This machine is designed to handle sheet metal up to No. 14 gage.

The machine is especially adapted to such work as the manufacture of cans for ice making, since a sheet can be bent at right angles at any distance from the edge and successive bends can be made to form a closed body from a single sheet. A 30-deg. bend can be made along the edge of the sheet, if desired.



Niagara 72-In. Power Folder and Brake

The sheet to be folded is placed on the front brackets, a gaging apparatus being provided to gage the work quickly. The operator then steps on the treadle that actuates the clutch, the clamping bar descends and grips the sheet, the folding bar swings up and back to make the bend, after which the clamping bar returns to its original position. The action is automatic and, by successive bends, a box pipe as small as 11 in. square can be made and removed from the machine without distortion.

Gages adapted for the work to be done can be furnished with the machine. The treadle operates a friction clutch and the drive is double back geared. All gears are of semi-steel and the pinions of steel, providing a strong drive.

The clamping bar is a steel casting and is guided at its ends by steel posts that slide in brass-bushed bearings. This bar is automatically moved up and down through a toggle lever system actuated by cams on the main shaft. The left-hand end of the clamping bar is pivoted on its guide post, so that the right-hand end can be swung around to permit removal of the work wrapped around the bar. An adjustment is provided to regulate the pressure of the clamping bar on the sheet.

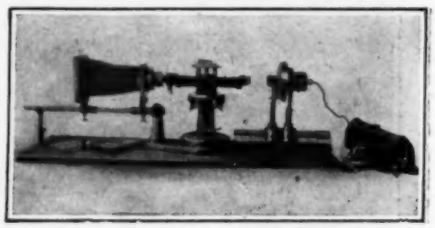
A safety device prevents the engagement of the clutch when the clamping bar is open. The folding bar is also a steel casting and is actuated by segment gears at either end of the machine. These gears are oscillated by crankpins on the drive gears, causing the bar to turn through the desired angle and back. The angle of the fold is regulated by adjusting the throw of the crankpins, which are mounted in T-slots in the gears. The length of the connecting rods between the crankpins and segment gears is also adjustable.

The floor space required by the machine is 152x92 in., and the shipping weight is approximately 12,000 pounds.

Microphotographic Attachment for Zeiss Portable Microscope

George Scherr, 143 Liberty St., New York, N. Y., is now marketing a microphotographic attachment for use in combination with the Zeiss portable microscope. The instrument was primarily intended for inspecting work in the shop, but, by the aid of this metallographic camera attachment, is adapted for the usual laboratory work as well.

In the accompanying illustration the apparatus is shown with the specimen to be photographed on a "Le Chatelier" table but a plain or ball-shaped table can be used for small irregular work. Both the plain and ball-shaped tables are regularly furnished.



Microphotographic Attachment for Zeiss Portable Microscope

The microphotographic attachment consists of a base on which all the components are mounted and secured in their proper positions by clamping bolts. A special illuminating tube with an eccentric diaphragm is provided, and the illuminating light source is a 50 c.p. Nitra bulb. The photographic equipment includes suitable lenses, a ground-glass slide, plate holders, and a stationary green filter.

For preliminary focusing the ground glass may be used, the final adjustment being made by a polished plate and a special magnifying lens. The plate holders will accommodate plates up to 3¼x4¼ in., and an arrangement for finding the proper exposure time is provided.

Selling Goods to the Orient

Sales of United States merchandise to the Orient are showing remarkable gains especially when compared with those to other parts of the world, according to a trade statement from the National City Bank of New York. Exports from the United States to Asia and Oceania in the eight months ending with February, 1924, the latest available record, show an increase of about 44 per cent over the same period of last year, while those to the remainder of the world show a gain of but about 7 per cent in the like period.

News of the Week

Gear Manufacturers Re-elect Markland President at Annual Meeting

New standards are vigorously discussed by members

Buffalo and the Hotel Lafayette evidently have a strong appeal to the members of the American Gear Manufacturers Association as they came back for their eighth annual meeting after an absence of two years. The meetings were well attended and the snap and go which characterized them under former President Sinram are still present with George L. Markland, Jr., in the chair.

The president's address on "The Year in Prospect" was a brief outline of the business and political situation as it affects the year to come. Mr. Markland pointed out how the advent of the A.G.M.A., and the work it had accomplished had changed the gear manufacturing shop from the ordinary garden variety of machine shop into a recognized industry of even more than national importance, because its membership and influence extend far beyond the borders of the United States. In this connection he dwelt on the necessity of organization and particularly of the work being done by the various committees, especially those on standardization. He urged co-operation from all members, and especially that members of committees should appreciate the importance of the work. His remark that "the chairman's gavel should be a claw-hammer, to pull the ideas out of members," was much appreciated.

Secretary Owen's Work

The work of the secretary, T. W. Owen, was outlined in his brief report, in which he pointed out the need of prompt replies to letters in order to speed the work of the association. He cited the case of an Australian member who wrote for suggestions as to the best machines to buy to equip a shop for automotive gear cutting, as being an unusual phase of the work of his office. The credit given the secretary by both the honorary president and the present encumbent, was highly commendatory.

Reports were received from the treasurer and various committees including entertainment, membership, public policy, legal and standardization. Mr. McQuiston, chairman of the publicity committee, had made a little investigation which showed that 94 per cent of those replying used the technical press and 6 per cent the general publications. A few also used local newspapers.

B. F. Waterman reported for both the general standardization committee and the sectional committee which is working with the A.E.S.C. The condition of the research work to be done in connection with the A.S.M.E. was also discussed by both Mr. Le Page and Secretary Owen. Much work has been done by the various committees and the first sheets of the A.G.M.A. handbook have been compiled, ready for distribution.

F. E. Eberhardt resigned as chairman of the Spur Gear Committee, the post being taken by J. L. Williamson of the General Electric Co.

Bound Volume Report

F. E. McMullen, chairman of the Bevel and Spiral Bevel Gear Committee sprang a surprise by presenting his report in the shape of a splendidly printed and bound volume of 148 pages, 9x12 in., contributed by the Gleason Works. This gives all data necessary for spiral bevel gears with pinions from 10 to 30 teeth and with mating gears up to 100 teeth. The volume forms a valuable addition to the available literature on gearing. The standards are those adopted by the A.G.M.A., in October, 1922.

The proposed standard for herringbone gears cut with a single tooth hob evoked considerable discussion from many angles and it was deemed best to refer it back to the committee for further consideration.

W. E. Sykes read an interesting paper on, "Gear Practice in England," pointing out some of the difficulties of competing with small one-man shops, which do not understand either overhead or depreciation. He mentioned the work of developing the herringbone gear for turbine work, giving as an example, a case of a 10 to 1 reduction that transmitted 1,340 hp. at a speed of 12,000 ft. per min. The gears were of chrome nickel steel, heat treated before cutting, but not hardened.

Russell C. Ball of the Philadelphia Gear Works, presented a paper on the value of cost accounting to the executive entitled, "What Have I Left Out?," in which he pointed out the many problems that beset the estimator on gear cutting work. These are frequently the result of insufficient data being furnished by the purchaser regarding special features such as long keyways in small bores, special pressure angles, heavy rims not shown on drawings and other factors that influence the cost of machining.

Low prices, he pointed out, are frequently not so much due to lack of knowledge as to cost, as to a desire to keep idle machinery in operation. In other words, business is taken below a fair price. On the other hand many shops do not know how to figure costs, the lack of fairly uniform cost accounting methods being a factor in this.

Another feature that is overlooked is that the average gear plant today is doing an engineering business as well as cutting gears. Furnishing engineering information costs money, whether you get the order or not, and must go into costs somewhere. Cost accounting also helps in determining when to discontinue the use of old types of machine tools in favor of other and more economical methods.

Sub-committee reports on worm gears, sprockets, gears and pinions for electric railways, mills and mines, and non-metallic gearing were presented.

Tuesday morning's session was marked by several lively discussions. It began with a report by the differential committee who reported more assistance from the S.A.E. than from the A.G.M.A. members. The committee have the 4-pinion differential fairly well standardized and hope to submit it at the next meeting. They are also at work on another style of differential, and hope to greatly reduce the types and variations of differentials, which now has as high as 49 variations in some cases.

Library Committee Report

Mr. Noble, for the library committee, presented a few pages of the new handbook as samples of the work being done, these pages being confined to well known standards of size of teeth, diameters of gear blanks, etc. He also proposed issuing a resumé of articles published, of interest to gear manufacturers.

Chester B. Hamilton of the metallurgical committee submitted a proposed standard for steel gear castings. This is almost in agreement with the A.S.T.M. committee's work and it is hoped to bring the two together so as to secure entire harmony on the specifications. Normalizing and annealing was also discussed.

For the tooth form committee, H. J. Eberhardt presented the proposed standards for a 20-deg. stub tooth and also for a full depth tooth. Mr. Eberhardt heartily commended both the Fellows and Nuttall companies for their co-operation and their willingness to adopt a new single standard in the interests of the gear industry. Both are well established and only broad vision and a desire to be of service on the part of the managements could have secured such co-operation. France

and Holland are both interested in standard tooth forms and are watching us in this respect.

The keyway committee report, presented by its chairman, Mr. Neilson, evoked lively discussion. The report proposes to use square keys in shafts up to 4 in. in diameter and rectangular keys for larger shafts. This differs from the A.S.M.E. committee report which proposes to use both square and rectangular keys. There was much discussion as to fitting keys, both for straight and taper holes and for various kinds of work. Some wanted two or more keys and others none at all, preferring to shrink or force gears on the shaft. Distortion, due to tight keys, and slack or back lash, because of loose keys, were both discussed freely.

It seemed to be the sense of the meeting that the subject should be more carefully considered and that clearances and tolerances as well as radius for keyway corners, be determined for various kinds of work.

L. G. Hewins, sales manager for the Van Dorn & Dutton Co., then presented a paper on "The Gear Manufacturer Needed." This paper will be reproduced in full in the near future.

The following were elected as members of the Executive Committee for a three year term: S. F. Sinram, H. E. Eberhardt, A. C. Gleason and A. F. Cooke. The meeting then adjourned to visit the Lumen Bearing Co., and other plants in Buffalo. The executive committee re-elected Geo. L. Markland as president; E. J. Frost, first vice-president; B. F. Waterman, second vice-president and Chas. F. Goedke, treasurer.

Fannon Speaks at Banquet

The banquet was presided over by President Markland and the speakers were James B. Horn, a Russian with a message from his home land, and S. F. Fannon of the Sherman Service Inc. Mr. Fannon in his talk, "The Seventy-five Cent Dollar in Business," stressed the growing need of amicable industrial relations and urged a careful consideration of the personnel problem as an aid in solving the difficulties which beset business of all kinds. The entertainment committee did itself proud, as usual.

On Wednesday morning after a brief talk on the work of the Industrial Relation Committee, E. S. Sawtelle, its chairman, proposed an experience meeting at the next session. He then read a most interesting paper on, "The Management's Responsibility in Industrial Relationship," in which he held management strictly to account. He believes that you must sell yourself and your organization to the employees, and that, as pointed out by Mr. Fannon the night before, the motive behind the movement is what really counts. Two pertinent remarks were that "rough neck foremen indicate a rough neck management" and that "there is no more excuse for inadequate pay than there is for inadequate work."

Neither the Metric nor the Inspection Committees had reports to present, but F. E. McMullen spoke on "The Application of Spiral Bevel Gears." This will be reprinted in an early issue.

Under the title of "Buying Habits of Industry," Mason Britton, vice-president of the McGraw-Hill Co., gave an illuminating talk and showed by lantern slides the results of a long series of investigations of industry in this country. Industry employs nearly twice as many people as agriculture, and produces over 54 per cent of the national wealth as compared with about 15 per cent for agriculture.

These facts have been gathered to help industry in solving its problems of distribution so as to secure the greatest returns from the sales efforts expended. The charts show where the markets are, who buys and how, the channels through which they are reached and the ways of appealing to the right men.

This was followed by a paper by J. C. McQuiston, "Advertising as an Investment for the Gear Manufacturer," in which he drew from his broad experience in securing publicity for mechanical products. This paper was widely discussed from several angles.

Stanley P. Rockwell in his paper, "Practical Metallography," emphasized the value of the microscope to the manufacturer, even in comparatively small plants, and showed that it was far superior to chemical analysis from the practical point of view. He gave several very striking examples of how the microscope solved shop difficulties and urged close contact and cooperation between the man responsible for heat treatment and the manager.

Programs Perfected for Auto Conventions to be Held in Detroit

Service Convention and World Congress plans complete

Many topics of interest to machinery and machine tool men will be discussed at the National Automotive Service Convention and the Automotive Maintenance Equipment Show to be held in Detroit, Mich., May 19, 20, 21 and 22. All sessions will be held in the General Motors Building as well as the exhibits and it is expected that a large delegation will be present from all parts of the United States and Canada.

"The Selection and Training of Repairmen" will be discussed by J. C. Wright, director of the Federal Board for Vocation Education. E. M. Young, of the advisory staff of the General Motors Corp. will speak on, "Shop Layout and the Selection of Proper Tools." This lecture will be illustrated with suitable slides.

On the afternoon of May 20 the following topics will be taken up and discussed: "How to Properly Fit Pistons and Bearings," by D. Andrews, service manager of the Continental Motors Motors Corp.; "Proper Adjustment of Rear Axle, Gears and Bearings," by Col. H. W. Alden, past president of the Society of Automotive Engineers and Chairman of the Board, the Timken Detroit Axle Co.; and "Adjustment of Brakes," by F. C. Stanley, chief engineer of the Raybestos Co.

The afternoon session on Wednesday will also have several speeches of interest to machine tool men. H. M. Crane, president of the Society of Automotive Engineers and technical assistant to the president of the General Motors Corp. will speak on "How the Service Man Can Co-Operate with the Engineer." L. A. Danse, chief metallurgist of the Cadillac Motor Car Co., will deliver an illustrated lecture on "The Effect of Heating Alloy Steel Parts—the Proper Way to Repair." The last speech of the afternoon will be delivered by Dr. W. K. Lewis, head of the department of chemical engineering, Massachusetts Institute of Technology, who has chosen for his topic "The Effect of Poor Lubrication."

The Maintenance Equipment Show will be open during the times when there are no sessions in progress and each morning, with the exception of the first, will be devoted by visits to the various exhibits. The show will also be open until 10 o'clock in the evening.

While the National Automotive Service Convention is in progress, the Motor Transport Congress will also convene at the Hotel Statler in the same city. The dates for this affair are May 21, 22, 23 and 24 and the list of subjects that will be discussed covers a wide range of topics. Among the speakers will be the following:

Alvan Macauley, president of the Packard Motor Car Co.; Sir Henry Worth Thornton, K.B.E., chairman of the board of directors and president of the Canadian National Railways; T. R. Dahl, vice-president of the White Motor Co.; John Hertz, president of the Yellow Cab Manufacturing Co.; Edward S. Jordan, president of the Jordan Motor Car Co.; F. J. Haynes, president of Dodge Brothers; A. R. Erskine, chairman of the Studebaker Corp.; Roy D. Chapin, chairman of the N. A. C. C. Highways Committee and an official of the Hudson Motor Car Co.; J. Walter Drake, assistant secretary of the Department of Commerce; H. H. Rice, president of the Cadillac Motor Car Co.; Alfred Reeves, general manager of the National Automobile Chamber of Commerce; and many speakers from Europe, South America, Australia and other foreign countries.

Ericsson Suggested for Hall of Fame

Efforts are being made to have the name of John Ericsson considered among those who will be nominated in 1925 for the Hall of Fame. At that time there will be consideration given to nineteen men and eleven women. Engineers complain that among the fifty-six men and seven women now in the Hall of Fame there are only four inventors and one engineer.

Industrial Engineers Discuss Problems of Importance at Convention

Buffalo meeting proves successful from every angle

The Society of Industrial Engineers held its 11th National Convention at the Hotel Statler, Buffalo, N. Y., on April 30, May 1 and 2, with the alluring subject of "Reducing the Cost of Business" as the major theme. This was discussed from various angles by Col. B. A. Franklin, who brought out the part played by the delivery of small orders in the cost of doing business, and a number of others. The luncheon of the Fatigue Committee was presided over by George Shepard, of Purdue, and a paper, "Illumination as a Fatigue Factor," was presented by Ward Harrison of the National Lamp Works.

A meeting of chapter delegates was presided over by W. W. Nichols of Detroit and Myron E. Forbes, president of the Pierce Arrow Motor Car Co., conducted a meeting on, "Reducing the Cost of Selling," at which Ralph Barstow was the principal speaker. A paper on the "Reduction of Cost through Industrial Engineering," by C. M. Bigelow, was presented by Robert Kent. This dealt with the product itself, the material used, carrying charges, inventories to manufacturing and sales departments, clerical costs, instruction of workers, sales force and executives, and stressed the necessity of putting integrity above expediency. The paper was discussed by James J. Martindale of Detroit and Alonzo Flack of New York.

Inspection Trip and Dinner

After inspection trips which occupied most of the day, the Research Committee held a dinner presided over by Charles B. Gordy of the University of Michigan. At this dinner William J. Corbett, industrial engineer of the Electric Steel Founders Research Group, presented a paper, "Reduction of Costs Through Co-operative Research Work," in which he told how five electric steel foundries were doing co-operative research and exchanging the results of their experience.

Frank B. Gilbreth gave a brief outline of his method of "Classification of Work," this classification applying to any branch of industry. He also told of the coming convention of engineers in Prague, Czecho-Slovakia, and urged the attendance of as many as possible. This was seconded by L. W. Wallace, executive secretary of the F.A.E.S., who gave further details.

There were three simultaneous debates in the evening, production managers, accountants and personnel groups. The production managers, presided over by Joseph W. Roe, discussed the proposition, "That Production Control Should Be Installed by a Consultant." The affirmative was taken by F. J. Knoeppel and Frank W. Van Ness, while Clifton Reeves and A. S. Cunningham took the negative. The accountants had a lively debate on the subject, "That Repair and Maintenance of Plant and Equipment Should Be Charged to the Reserve for Depreciation rather than to Current Operations." George P. Ellis, and Carbis A. Walker took the affirmative, while Charles B. Williams and P. D. Luby upheld the negative with considerable vigor. The personnel group discussed, "The Rating of Executives for Promotion on a Plan Similar to the Army Tests." The speakers were W. S. MacArthur, formerly of the Army, for the army tests, while Arthur L. Mann and Chas. B. Gordy opposed the plan.

Important Topics

The all important subject, "Reducing the Cost of Manufacture," occupied the morning of the last day with Karr Parker presiding. The first paper was by Keppele Hall who stressed the point that all overhead was not wasteful but frequently an economy, depending on what made up the overhead. This was discussed by H. E. Sims and Elmer W. Coffey, representing knit underwear and printing, respectively.

F. W. Pierce of the Goodyear Co., spoke of the "Part of the Personnel Manager in Cost Reduction," going into detail as to the workings of his department. This company uses the Flying Squadron plan to keep production going in various departments, the men being trained to handle the work in any department. In addition they have an hour a day in school where they are taught economics of manufacture and kindred topics.

The meeting closed with a banquet at which W. G. Sheehan, president of the S.I.E. was toastmaster, the address being given by L. W. Wallace, on "Education, Civilization and Peace." The Rev. L. E. Smith spoke on "Where Happiness Meets Success."

New York Losing Metal Working Shops

The metal industries, with more than 250,000 employees, said to be the largest employers of labor in New York City, are showing a marked tendency to move from Manhattan and Brooklyn into New Jersey and Queens, according to the report of a survey made public recently by the Committee on Regional Plan of New York and its Environs that has been studying the situation.

The survey on which the report is based covered manufacturing plants in every branch of the metal industry, ranging from pins to printing presses and from platinum rings to plumbing supplies. The migration of metal plants from New York has been in progress for several years, the report states, and it is at present even more definitely apparent than in the past. The tendency is strongest among plants producing heavy or bulky products.

The general movement of plants first assumed the phase of a migration from Manhattan to Brooklyn. Recently the movement appears to have entered a second stage, the general trend being away from Brooklyn toward Queens and New Jersey.

In the case of both metal and chemical plants, the chief reason for the trend toward New Jersey and Queens appears to be the need for larger tracts of land and cheaper land than is now obtainable in the heart of the New York region which is giving way to high office buildings and lofts for lighter manufacturing.

March Exporting of Machine Tools

Exports of metal-working machinery during March, 1924, with revised comparative figures for March, 1923, taken from the records of the Department of Commerce, are as follows:

	March, 1923 VALUE	Mrch, 1924 VALUE
Lathes	$57,728	$70,937
Boring and drilling mach...	47,543	45,922
Planers, shapers and slotters	10,786	22,725
Bending and power presses	7,850	25,669
Gear cutters	11,199	65,653
Milling machines	32,474	29,930
Thread cutting and screw machines	39,991	41,566
Punching and shearing machines	7,724	4,940
Power hammers	24,791	14,434
Rolling machines	4,038	11,944
Sharpening and grinding machines	101,102	.....
Chucks, centering, lathe drill, etc.	20,847	21,821
Reamers, cutters, drills, taps, dies and other metal working tools	165,407	149,127
Pneumatic portable tools..	49,820	60,766
Foundry and molding equip	43,314	36,997
Other metal working machinery and parts of	328,469	326,545
Metal-working machinery (total)	953,083	1,057,078

New Machinery Firm in Tokyo

A new stock company has been formed in Tokyo, Japan, for the purpose of dealing in machine tools, work shop equipment, hand tools, steam and pneumatic fittings, packing and belting, track tools, general industrial supplies and hoisting and conveying machinery. It will deal only by wholesale and on a consignment basis representing many houses in the United States. The new company will be known as Kyodo Kikai Hanbaisho, which means Co-Operative Machinery Stores, Ltd. The address given is 28, Sanchome, Honzaimoku-cho, Kyobashiku, Tokyo, Japan.

The company is an outgrowth of the recent earthquake in Japan. At that time it was necessary to get quickly supplies of machinery, machine tools and hardware and by an arrangement, machinery dealers in Osaka furnished dealers in Tokyo with the necessary stock. After conditions were improved it was decided that a permanent arrangement between the dealers would be of benefit and would work to mutual advantage.

The managing directorship is now held by H. Okuda, who was formerly associated with Horn & Co., and the officers of the association are all reputable business men in that part of Japan. The company is anxious to communicate with all machine tool and machinery manufacturers in the United States.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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THE announcement that the Federal Reserve Bank of New York had reduced its rediscount rate from 4½ to 4 per cent was the most important news of last week. The fact that Governor Crissinger was in New York when the reduction was ordered is regarded by some as an indication that the Administration has determined to apply the stimulus of cheap money to business. This is, however, unlikely, for it has for some time been plain that the Federal Reserve Banks would have to find a way to employ their funds if they were to make expenses. The statement published last Friday shows a reserve ratio of 82 per cent for the system and earning assets of only $874,000,000 out of total resources amounting $4,811,000,000.

These figures explain why the rate was lowered and the only wonder is that the reduction was so long delayed.

Most of the other Federal Reserve Banks are expected to follow the example of the New York institution and a better demand for seasoned stocks and bonds is anticipated. The bond market is in fact already higher and the 100 millions of new issues brought out during the week were readily absorbed. They include $40,000,000 bonds of the Kingdom of the Netherlands (Holland) offered on a 6.10 per cent basis, and $12,000,000 bonds of the Hearst Publications, Inc., which owns five California dailies and five monthly magazines published under the direction of William R. Hearst.

The latter issue, which was sold to the public at a price which yields 6½ per cent, is regarded as the precursor of many similar flotations as it is coming to be realized that our large expenditure for advertising gives the well established newspaper or magazine an earning power and value that make its shares or bonds legitimate and attractive investments. The desirability of such investments has been for some time recognized in England and it seems altogether likely that newspaper shares will soon become fashionable in the United States.

Next in importance to the reduction in the Federal Reserve rate is the recommendation made by the British Chancellor of the Exchequor that the import duties on sugar, tea, coffee, cocoa and chicory should be cut in half and that sundry other duties, including the duty on imported automobiles, should be reduced by 33 per cent after the first of August.

As these recommendations were accompanied by a budget which showed a substantial reduction in the public debt of Great Britain, they have given great satisfaction and are regarded as ensuring the popularity of the Labor government for some time. The effect upon British trade has also been tonic and it is manifest that things in Europe are improving despite the delay over the acceptance of the Dawes report that now seems probable.

That a German loan of $200,000,000, of which the United States will be expected to take half will be made a condition precedent to a final settlement with Germany is inferred from what General Dawes said upon his arrival from Europe last week. The preparation of the American market and American sentiment for such a loan is a problem in applied psychology that is already engaging the attention of the bankers who will probably handle the business. It is an interesting process that is well worth watching.

Most markets are meanwhile quiet. As compared with last year there has been a slight reduction in distributive trade, but it is neither significant nor important.

The production of steel is about 20 per cent below the peak of March, but the Steel Corp. has declared another extra dividend of 50 cents a share on the common stock and it is estimated that the railroads will spend $85,000,000 in improvements and new construction during 1924.

A slight increase in crude oil production is reported for the week, but the supply available is well under control and the surplus carried over from last year is being sold at prices which show a substantial profit to the holders.

Savings bank deposits increased $1,140,000,000, or at the rate of 3 million dollars a day during 1923, and the total gain in the invested wealth of the country during that year is estimated at $12,000,000,000 by Vice-President Gehle of the Mechanics & Metals National Bank.

Present indications are that the additions to our invested capital during 1924 will be quite as large and, while there will always be areas in which, for special reasons, business is slack, conditions are upon the whole satisfactory. Merchants are carrying small stocks. Most of their floating debt is funded or paid and the stage is set for a widespread revival of activity whenever anything happens to quicken the energies of our business men.

It may be that lower interest rates will have that effect. They did in 1897 when money ruled at or near 3 per cent and we entered upon seven years of the greatest prosperity this country has ever known. The history of that period might be studied with profit by those who are now pessimistic.

What's Doing in Industry

There has been little change in the machinery and machine tool business during the past week and from the various parts of the country come reports that dealers and manufacturers are looking for improvement later in the year. Nothing can be said for the immediate future, however, except that automobile makers will probably be in a better position to buy during May and June than they were in April.

General business is not as good as it has been and reports show a steady decline in freight car loadings, which is generally taken as an indication that goods are not moving with the celerity that they were during the past six months. But in spite of this condition the country is far from depression and there is a feeling of optimism prevalent.

Steel production is not up to the record of a few weeks ago but is still on a good basis and will probably continue so for this quarter. Judge Gary's statement and the payment of the usual extra dividend of 50 cents a share failed to change the price of the common stock, as speculators believe business will be no better than it was during the first quarter.

Automobile production has improved slightly but it is still below estimates made during the first quarter of the year. Electric goods are moving fairly well and there is no sign of let-up.

Exporting business is reported as continually improving and this should be welcome news to all industrialists. With the Dawes report receiving favorable comment in Europe, there seems to be hope for better business from the Old World in the near future.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Detroit

Improvement in conditions in the machine tool and machinery field in Detroit and nearby industrial centers is confidently expected by leading executives as automotive factories turn to heavier schedules than maintained for the past few weeks.

As one of the best-informed men in the machinery line put it: "Our April business is a vast improvement over our worst month last year and April will probably be our worst month this year."

Rumors that business is bad in Detroit are being spread about in outside cities, according to some of the local machinery men who have visited other centers recently. How seriously these are being taken is indicated when mention is made that one machine tool executive said that "Ford is laying off men by the tens of thousands." Nothing could be further from the truth, and Detroit machinery men have found numerous occasions recently to deny these ill-founded rumors, as the weekly figures of the Employers' Association show those on the weekly payroll here as about 237,000 as against a peak for all time of 241,000.

Inquiries and orders for special machinery are being received by the larger firms, standard equipment finding but little sale in this territory.

Some of the smaller manufacturing plants are curtailing purchases to some extent, but this condition has not assumed any alarming proportions.

With the exception of two plants, every automobile factory in the district has inaugurated increased production schedules.

New York

Business pursued a more or less even tenor this week in the machinery and machine tool lines in the New York district. Nothing out of the ordinary took place and the business transacted was mostly with railroads with here and there a sale of a single machine to a general industrial. Other sources were not in the market for tools and there was about the average number of inquiries from all sources. Automobile accessory makers are getting into a position to buy and there is some little hope held out by the electrical goods makers so that the month of May will not be devoid of business altogether.

Most dealers in the Metropolitan district are looking forward to better business after June, but until that time only the usual replacement business is expected.

While it is understood upon reliable source that sales are being made to Japanese interests, this business is hard to locate and it is impossible to tell the exact amount. Other export business is going along at a rate better than last year with every indication that it will continue to improve during the next few months.

Dealers in used machinery say that their business is about average, which is better than they had hoped for a few weeks ago.

The Southern railway, the New York Central and the Lehigh Valley all closed on small lists during the past week.

Milwaukee

Some relief from the stagnation noticeable in the character of business in metalworking equipment during the first two weeks in April has come, and while the acceleration so far in May is by no means conspicuous, the tone of sentiment in the trade is of a more encouraging nature. Clarification of the situation in the passenger automobile business by the expected quickening of retail sales in the past two to three weeks is confidently expected to have a favorable effect on tool trade. Although a few of the largest makers have been doing some buying right along, the majority of concerns were out of the market for anything beyond purely replacement needs, pending developments from an admittedly overbalanced production situation.

The woodworking industry is giving manufacturers of machinery for logging and lumber manufacture a healthy volume of new business. Automobile body factories and the high grade furniture trade continue to expand capacity and to replace fairly new equipment with new machines designed for maximum production, and for meeting the need for highly skilled help. Probably no machine shops in this territory are so busily engaged with work as those building woodworking tools, and in a majority of cases unfilled orders are liberal and cover deliveries well into the late summer and early fall seasons of the present year.

So far as tool manufacturers here are concerned, very little railroad patronage has been received, and this consists largely of special designs rather than standard tools in stock.

Judging by the activities of builders of heavy duty gas engines for motor trucks and motor buses, this division of the automobile industry continues to enjoy good business, although it is more in the direction of the passenger bus than in freight vehicles.

On the whole, the expectancy concerning May business is for an average volume, compared with preceding months this year. Most dealers look for at least a slight increase over the April average, because of the less unfavorable tone of general industrial sentiment locally and elsewhere.

Indianapolis

With all due regard to the optimists, business is not very good among the machinery and tool men of Indianapolis. During the last two weeks, various things have occurred that have caused a slump in business. In the first place, the demand from the automobile industry has decreased. Not only have the factories themselves curtailed production, but the accessory manufacturers and the body builders also have been influenced accordingly. The automobile industry is buying only what it actually needs and this is little. Not only this, but those most closely associated with the industry say it likely will be some months before this particular industry recovers unless there is a far greater demand than there appears to be now on the part of the dealers.

Railroad shops in various sections of Indiana are slowing down their work. The big Beech Grove shops in Indianapolis closed this week for repairs. There has been some machinery purchased for these shops and this must be installed before the shops re-open.

There are some bright spots, however, The demand for brick and coal mine machinery is on the upgrade. Dealers and manufacturers of this sort of machinery say most of the mines now are down and are using the time to make a lot of betterments and replacements. The brick machinery business has been good all spring. The utilities, notably the electric power utilities, are buying some specialized machinery. The milling machinery business is a little better, according to officials of the Nordyke-Marmon Co. E. C. Atkins & Co. officials say demand from West coast lumber mills continues to be satisfactory.

Canada

The demand for machine tools in Canada has shown some improvement during the last two weeks. Prospective buyers are now sending out inquiries for replacement purposes and new works. Selling interests are looking forward to a stronger demand in the very near future, dependent on the effect which the tariff changes will have on large industries. Meanwhile the transportation facilities are the steadiest customers. Scrap markets in the Eastern centres are uncertain. Although the demand on mill account is said to be good, most of the foundry interests are buying in small lots for immediate requirements.

The Canadian National Railways have placed orders for fifteen more of

the 6,000 type of locomotive, the largest passenger engines in Canada, with the Kingston Locomotive Co., and also for eighteen of the Mikado type with the Canadian Locomotive Co., Montreal. Five new freight locomotives, of the Santa Fe type, with ten drive wheels, and designed for the heaviest freight service, have been ordered from the Kingston Locomotive Co. The steel mills are maintaining a high rate of production. The total of iron and steel produced in March was considerably ahead of totals for the past several years. Automotive manufacturers are carrying out large spring programs and allied industries are benefiting from extensive orders.

The Canadian Car and Foundry Co., Montreal, have shipped two first-class passenger cars to the Toronto, Hamilton and Buffalo Railway, and have received orders from the Canadian National Railways for four parlor-buffet observation cars and six parlor cars.

Foreigners Requesting American Machinery

An unusual number of requests for catalogs of American machinery have been received by the Department of Commerce during the past week.

An inquirer of the Rio de Janeiro office of the Bureau of Foreign and Domestic Commerce plans the erection of an iron and steel plant to produce 20 metric tons of pig iron per day, using charcoal. He is reported as having sufficient backing for his enterprise and is desirous of receiving catalogs and propositions from American manufacturers of steel plants and equipment.

An inquirer at the Brussels office of the Bureau of Foreign and Domestic Commerce requests catalogs on machinery for manufacturing containers from steel sheets. The inquirer also wishes quotations on galvanizing machinery for use in his plant. Firms forwarding catalogs should address them "To the Office of American Commercial Attaché, 25, Place de l'Industrie, Brussels, Belgium, (Reference No. 384)."

The office of the American Trade Commissioner at Johannesburg, South Africa, invites manufacturers of machinery for manufacturing sugar from sugar beet to forward catalogs of descriptions of installations, price lists, etc.

Catalogs on machinery used in shoe factories have been requested from American firms by the office of the Bureau of Foreign and Domestic Commerce at Alexandria, Egypt. The recent opening of a shoe factory and its successful operation may indicate a development of this industry, and catalogs describing American shoe machinery will be of value should the erection of another plant be considered in the future.

Firms wishing to send catalogs may forward them to the Industrial Machinery Division of the Department of Commerce for transmission. Covering letters should be in duplicate, and all catalogs marked as follows: "To the Industrial Machinery Division, Room 815, Bureau of Foreign and Domestic Commerce, Washington, D. C. For transmission to office of Trade Commissioner, Rio de Janeiro, Brazil, (Reference No. 367-3/20)."

England Stops Auto Duty; Canada Loses

A storm of protest has arisen in Canada over the termination of the automobile duties in England. It is pointed out that since the war the Canadian export trade in motor vehicles has developed in an encouraging manner. It is claimed that the fact that cars manufactured in Canada entered Great Britain under the preferential rate of 22½ per cent as compared with the 33⅓ per cent paid on United States cars, had considerable to do with this development. With the wiping out of the duties, cars from both countries will enter Britain free. It is feared that United States manufacturers with plants in Canada will now want to do all their manufacturing in the United States, which will mean the removal of the Canadian plants.

George McLaughlin of Oshawa, whose company during the past two years has enjoyed a very healthy export business, said this healthy tone was due to the McKenna preference on Canadian cars. "There is no doubt that this change in the tariff will be a serious blow to Canadian manufacturers," he said.

While Canada's total exports of automobiles during the year ending March, 1924, were $5,600,000 in excess of those for the preceding period, there are indications that the peak of the export trade in this line has been reached, and that it will be fortunate if the present level of exports is held. The value of exports of freight automobiles was $396,000 greater than during the same month last year, but on the other hand the value of passenger automobiles exported was $146,000 less than it was a year ago. From this it is evident that a reduction in shipments of cars to the United Kingdom this year would be a rather serious matter for the automobile industry.

Franklin Distributes Suggestion Prizes

Cash prizes aggregating $3,932 were distributed to 254 employees of the Franklin Automobile Co. on the evening of April 22, in connection with the termination of the fifth Franklin Suggestion Contest conducted by the Franklin company for its workers.

Prizes were awarded at a testimonial banquet given to prize winners, officials of the company and heads of departments taking part in the ceremony. The prizes ranged from $400 downward. The Suggestion System, inaugurated at the Franklin plant on March 21, 1921, has been thoroughly successful and many hundreds of valuable ideas have been advanced by the employees tending either to improve the quality of the Franklin car or to cut down the cost of production without impairing quality.

Personals

GEORGE C. MCMULLEN, formerly manager of sales of the Industrial Division of the Timken Roller Bearing Co., Canton, Ohio, has been made district manager of sales on the Pacific Coast with headquarters in San Francisco, Calif.

HOWARD U. HERRICK, who has been factory manager of the Brown-Lipe Gear Co., Syracuse, N. Y., for the past four years, has recently been appointed vice-president and general manager of the V & O Press Co., Hudson, N. Y.

O. C. RADFORD has been appointed manager of the Atlanta branch of the Graton & Knight Manufacturing Co., Worcester, Mass. Mr. Radford was formerly manager in the New Orleans district. He will have charge of the Carolinas, Florida, Alabama, Georgia and sections of Tennessee and Mississippi.

THOMAS MIDGELEY, JR., vice-president of the General Motors Chemical Co., New York, addressed the joint meeting of the Milwaukee Section, S. A. E., and the Engineers' Society of Milwaukee at the City Club, Wednesday, May 7, on "Fuels."

JAMES H. BURGESS has been appointed Michigan representative for the Bantam Ball Bearing Co., of Bantam, Conn. Burgess is a manufacturer's agent with headquarters in the General Motors Bldg., in Detroit.

E. C. HOWARD has been appointed to the executive staff of the Fisher Body Corp., Detroit. Mr. Howard was formerly vice-president of the Lafayette Motor Co.

AUSTIN M. MUELLER, general manager of sales of Joseph T. Ryerson & Co., Chicago, was the guest of honor at a dinner in that city April 26 tendered by his associates to commemorate his completion of twenty-five years with the company.

CLARENCE F. TOLLZIEN, Detroit, direct factory representative for the Billings & Spencer Co., the Spring Perch Co. and the Dahlstrom Metallic Door Co., has moved to new headquarters, 5-251 General Motors Bldg.

M. J. KENNEDY is to cover the South Carolina territory for the Graton & Knight Manufacturing Co., Worcester, Mass. He has been with the company for the past four years.

T. R. HARRISON, formerly associated with the pyrometry department, Bureau of Standards, and more recently with the Champion Porcelain Co. of Detroit, has assumed charge of the research department of the Brown Instrument Co.

HARRY H. GILDNER, formerly in charge of the Chicago office of the Timken Roller Bearing Co., Canton, Ohio, has been made manager of the Industrial Division with headquarters in Canton.

W. J. CLUCAS, recently district manager for the Lancaster Steel Products Corp. at Buffalo, has been oppointed district manager for that concern with headquarters in Detroit. He succeeds F. N. ADGATE, who joins the General Motors Export Co. and who will travel South America for the company. The Lancaster corporation is a G. M. C. subsidiary.

W. E. COLE and C. G. GILBERT, who did a partnership business as the Manufacturers Sales Co., Detroit, have dissolved partnership. Mr. Cole continues to operate under the name of the Manufacturers Sales Co. as agent for the R. G. Haskins Co., the Service Caster & Truck Co., the Knight Engine & Sales Co. and the Lovejoy Tool Co.; Mr. Gilbert will take care of the Federal Products Corp., of Providence, R. I., under his own name. Both have headquarters at 1645 Howard St.

OSCAR BREWER, formerly at the Philadelphia office of the Leeds & Northrup Co., has been placed in charge of the company's new Cleveland office located at 1271 Union Trust Building.

M. K. EPSTEIN has resumed his activities in the sale of heat treating equipment by organizing and becoming general manager of the Heat Treating Equipment & Supply Co., with offices at 983 Main St., Hartford, Conn.

A. J. BRANDT, of Janesville, Wis., has been appointed manager of the Pacific Malleable Co., Oakland, Calif., a newly established branch production unit of the Forbes Malleable Co., Rockford, Ill. Mr. Brandt went to Janesville in 1918 to join the engineering staff of the Samson Tractor Co., and upon its liquidation, was appointed manager of the Janesville unit of the Fisher Body Corp.

A. W. LAMONT, assistant manager of the Canadian Westinghouse Co., Winnipeg, has been appointed president of the Western Engineering Co., which recently became affiliated with the Newark Electric Furnace Co., and will specialize in this line throughout Canada.

D. F. POTTER, JR., has charge of the recently opened New York office of the Kuhlman Electric Co., Bay City, Mich. The office is located at 300 Madison Avenue.

BARTLETT FERRIS has been appointed purchasing agent for the plant layout and mechanical division of the General Motors Corp., Detroit.

THEOBALD C. WEISS, formerly superintendent of the Fitzgerald Manufacturing Co., Torrington, Conn., has become president and general manager of the National Electric Manufacturing Co., Inc., of New Haven, Conn. The company makes the Arnold portable electric drill, formerly made by the Arnold Electric Tool Co.

T. T. LOVELACE, president of the Lovelace Engineering & Manufacturing Co., of Oldsmar, Fla., has purchased the properties of the Oldsmar Manufacturing Co., also of Oldsmar, and will build an addition for the manufacture of brass castings and automobile accessories.

Business Items

The Cramer Manufacturing Co., 387-389 Tenth St., Milwaukee, has changed its title to Milwaukee Circulating Pump & Manufacturing Co., to better designate the character of its principal business, that of manufacturing auxiliary pumping systems for Ford cars and a general line of pumps and equipment.

The Westinghouse Electric & Manufacturing Co. has moved its executive offices from 165 Broadway to the new home of the Westinghouse company at 150 Broadway, New York City. The new building is known as the Westinghouse, and all departments of the company will conduct business from there starting May 1. The Westinghouse Electric International Co. and the Westinghouse Lamp Co. will move into the new building soon.

The Pittsburgh office of the Sullivan Machinery Co., Chicago, has been moved from the fifteenth floor of the Farmers Bank Building to the fifth floor of the same building. The new quarters are much larger than the former ones.

The Bristol Co., Waterbury, Conn., has leased part of the Larkin Building, 3617 S. Ashland Ave., Chicago, which it will use for repair headquarters in the middle west district. The present salesroom and offices in the Monadnock Building will still be maintained.

At the annual meeting of the stockholders of the Firth-Sterling Co., McKeesport, Pa., the following officers were elected: Lewis J. Firth, president; Eben B. Clarke, vice-president; D. E. Jackman, treasurer. These officers together with L. Gerald Firth and Thomas D. McCloskey make up the board of directors. E. D. Gray was elected secretary of the company.

The St. Louis Steel Casting Co., St. Louis, Mo., has installed a bessemer converter system and will be ready to produce within a short time, according to a recent anouncement.

The D. S. Slusser Sales Co., Detroit, Mich., has been appointed sales representative for Michigan, northern Indiana and northern Ohio for the Meldrum-Gabrielson Corp., Syracuse, N. Y.

The Detroit branch of the McCroskey Tool Corp., Meadville, Pa., is now located at 2970 W. Grand Boulevard.

The Eastern Machinery and Equipment Co., Philadelphia, has purchased the Ace Motor Co.

J. D. Wallace & Co., 1401-1417 W. Jackson Boulevard, Chicago, Ill., will soon move into their new building at 134-158 S. California Ave.

The Tombs Rotary Motors, Ltd., has been granted federal incorporation in Canada to deal in all kinds of automobiles, motors, engines, machines, accessories, and all kinds of machinery. The company is capitalized at $100,000, with headquarters in Toronto. The incorporation are: Reginald A. Tombs, Abraham Freeman, Israel Freeman and Harry Freeman, all of Toronto.

The purchase of the Automotive Corp. of Hazleton, Pa., by the Victor Piston Pin Co., Indianapolis, has been announced by D. L. Fryer, president of the Indianapolis firm. The Hazleton purchase will be moved to Indianapolis for consolidation with the holdings of the Indianapolis company. The Hazleton equipment and business will practically double that of the Indianapolis company. The business is devoted to the manufacture of piston pins for airplanes, motorcycles, motor boats and automobiles. The officers of the firm, in addition to Mr. Fryer, are, J. N. Gallagher, vice-president, Victor H. Carmen, treasurer, and L. H. Fryer, secretary.

Export Opportunities

HENRY MALISON BYLLESBY, well known Chicago engineer, died suddenly while in a dentist's office. Death was due to heart trouble from which Mr. Byllesby had been suffering for several years. He was a member of the A.S.C.E. and the A.S.M.E.

HERBERT J. LOUNT, comptroller of the Cadillac Motor Car Co., Detroit, died at his home, April 17, after an illness of less than two weeks. Mr. Lount had been in the service of the Cadillac company for nearly 20 years.

Forthcoming Meetings

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

National Association of Purchasing Agents. Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer 1315 Spruce St. Philadelphia, Pa.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—While the volume of pig-iron buying is increasing slightly, it is confined mostly to small tonnage lots. Birmingham base is still $22@$23 per ton for No. 2 f'd'y iron. Coke, iron and steel output decreasing. Steel export demand fairly good; domestic consumers' stocks getting low. Steel bars now quoted at $2.25@$2.30; shapes, $2.25@$2.30 and plates, $2.20@$2.30 per 100 lb., f.o.b. mill.

Non-Ferrous Metals—Slight improvement in demand for electrolytic copper; current market, however, is ¼c. per lb. below April 25, in New York. Tin and lead quiet, although the former is ¼c. per lb. below and the latter, ⅛c. above the April 25 level. Zinc market unsettled, with price ⅛c. per lb. higher than on April 25. Antimony and other non-ferrous metals easier, with prices unchanged.

(All prices as of May 2.)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22@23
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	$2.85@3.00	4.34	3.65	4.00
No. 12	2.95@3.10	4.39	3.70	4.05
No. 14	3.05@3.20	4.44	3.75	4.10
No. 16	3.25@3.40	4.54	3.85	4.20
Black				
Nos. 17 and 21	3.70	4.65	4.35	4.55
Nos. 22 and 24	3.75	4.70	4.40	4.55
Nos. 25 and 26	3.80	4.75	4.45	4.60
No. 28	3.85	4.85	4.55	4.70
Galvanized				
Nos. 10 and 11	3.80@4.00	4.90	....	4.60
Nos. 12 and 14	3.90@5.10	5.00	....	4.70
Nos. 17 and 21	4.20@4.40	5.30	....	5.00
Nos. 22 and 24	4.35@4.55	5.45	5.10	5.15
No. 26	4.50@4.70	5.55	5.35	5.30
No. 28	4.80@5.00	5.85	5.65	5.60

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 34@5% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	¾	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.40
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	4.10	4.00
Cold drawn flats, squares	4.90	4.60	4.50
Structural shapes (base)	3.59	3.46	3.30
Soft steel bars (base)	3.49	3.36	3.20
Soft steel bar shapes (base)	3.49	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.59	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.49	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.87½
Tin, 5-ton lots, New York			49.25
Lead (up to carlots), St. Louis	7.60	New York	8.37½
Zinc (up to carlots), St. Louis	5.85	New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.00	30.00	28.50
Antimony (Chinese), ton spot	11.25	12.00	10.00
Copper sheets, base	21.25	20.75@21.00	23.00
Copper wire, base	16.75	18.75	16.25
Copper bars, base	20.50	22.00	19.50
Copper tubing, base	22.75	27.00	23.00
Brass sheets, base	17.75	21.50	18.75
Brass tubing, base	21.50	26.50	20.50
Brass rods, base	15.50	17.50	15.75
Brass wire, base	18.25	21.50	....
Zinc sheets (casks)	10.75	11.00	....
Solder (½ and ½), (case lots)	37.00	34.50	30.00
Babbitt metal (83% tin)	60.00	61.00	48@52
Babbitt metal (35% tin)	28.00	19.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54. 00
Manganese nickel hot rolled rods "D"—high manganese (base) 57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	40. 00
Blocks	32. 00	Cold drawn rods (base)	48. 00
Ingots	38. 00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.25@11. 00	10. 50	10. 75
Copper, heavy, and wire	9. 87½@10. 75	10. 00	10. 00
Copper, light, and bottoms	7. 87½@9. 75	8. 50	9. 00
Lead, heavy	6. 00 @7. 75	6. 00	6. 50
Lead, tea	3. 50 @6. 50	3. 50	5. 50
Brass, heavy, yellow	5. 12½@7. 00	... ...	6. 50
Brass, heavy, red	7. 37½@9. 25	9. 00	8. 50
Brass, light	4. 37½@6. 00	5. 00	6. 00
No. 1 yellow brass turnings	4. 37½@7. 00	6. 00	6. 50
Zinc	3. 37½@4. 00	3. 50	3. 50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$24. 30	$22. 85	$18. 50
"A" Grade:				
IC,	20x28, 112 sheets	20. 20	18. 00	17. 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14. 00	13. 00	14. 50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8. 25	6. 55	7. 40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 14@0. 21	$0. 20	$0. 14
Cotton waste, colored, per lb.	. 09@ .12½	.17	. 10½
Wiping cloths, 13¼x13¼, per lb	11. 75	36. 00 per M	. 16
Wiping cloths, 13¼x20½, per lb	....	52. 00 per M	. 16
Sal soda, per 100 lb.	2. 40	2. 25	2. 65
Roll sulphur, per 100 lb.	3. 60	3. 50	3. 50
Linseed oil, per gal., 5 bbl. lots	. 95	1. 02	. 94
Lard cutting oil, 25% lard, per gal.	. 55	. 50	. 79*
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	. 35	. 40
Belting—Present discounts from list in fair quantities (⅓ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50%	50–10%	40–10%
Second grade	50–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5. 40	$5. 84	$6. 48
Emery paper	9. 90	11. 00	8. 80
Emery cloth	31. 12	31. 12	29. 48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 24	1. 40
Cloth	3. 38	2. 67	3 20
Fire clay, per 100 lb. bag	... ...	. 65	. 60
Coke, prompt furnace, Connellsville	per net ton		3. 75@4. 00
Coke, prompt foundry, Connellsville	per net ton		4. 75@5. 50
White lead, dry or in oil	100 lb. kegs		New York, 15. 00
Red lead, dry	100 lb. kegs		New York, 15. 00
Red lead, in oil	100 lb. kegs		New York, 16. 50

*Chicago quotes on pure lard oil, No. 1 grade.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0349	$0.0354	$0.0354
Cold finished shafting	per lb.	0.044	0.044	0.044
Brass rods	per lb	0.155	0.16	0.20
Solder (½ and ½)	per lb.	0.37	0.39	0.335
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.60
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	55–5%
1¼ and 1½x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3. 50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3. 50 net	$4. 00 off
Button head bolts, with hex. nuts	List net	List net	3.50
Hex. head and hex. nut bolts	List net	.....List plus 10%	
Lag screws, coach screws	45%	.....	50-5%
Square and hex. head cap screws	75%	75%	75–5%
Carriage bolts, up to 1 in.x30 in.	35%	05%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55-5%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 9/16 and smaller	65%	.....	.....
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6. 50	$4. 00	$4. 00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5. 50	4. 00	4. 00
Washers, round plate, per 100 lb. Off list	1. 50	4.00	4. 00
Nuts, hot pressed, sq., per 100 lb. Off list	1. 00	3. 50	3. 50
Nuts, hot pressed, hex., per 100 lb. Off list	1. 00	3. 50	3. 50
Nuts, cold punched, sq., per 100 lb. Off list	1. 00	3. 50	3. 50
Nuts, cold punched, hex., per 100 lb. Off list	1. 00	3. 50	3. 50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5. 00	$3.60	$3. 75
Cone heads, ditto (net)	5. 20	3.80	3. 95
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0. 25	.....	0. 15
⅜ in. diameter *EXTRA*	0. 35	.....	0. 15
½ in. diameter *EXTRA*	0. 75	.....	0. 50
1 in. long, and shorter *EXTRA*	0. 75	.....	0. 50
Longer than 5 in. *EXTRA*	0. 50	.....	0. 25
Less than 200 lb. *EXTRA*	0. 50	.....	0. 50
Countersunk heads *EXTRA*	0. 45	.....	$4.20 base

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Md., Baltimore—Carey Machine & Supply Co., 119 East Lombard St.—screw machine for cutting feed screws ¼ to 2½ in. diameter, 18 in. to 4 ft. long.

Mass., Boston—Keystone Mfg. Co., 53 Wareham St. (toys)—rotary slitting shear with one or more spaces for cutters.

Mass., Boston—G. B. McLaughlin Mfg. Co., 24 Washington St. (machinery)—saw table, bandsaw and planer.

Mass., East Boston (Branch of Boston—Boston Sand & Gravel Co., 300 Conder St.—one shipyard bandsaw, with tilting saw and not less than 40 in. wheel, 2 ton; punch and shear, capacity 1¼ in. holes in 2 in. plate.

Mass., Quincy—Worthington Co. (contractors)—2 drum gasoline hoist with 4 cylinder engine.

N. Y., Canton—J. J. Collins, West Main St.—bench planer and 16 to 20 in. post drill for machine shop.

N. Y., Fayetteville—L. and J. S. Stickley, Inc. (manufacturer of furniture), A. Armine, Purch. Agt.—tapping, pipe threading and cutting machinery.

N. Y., Hoosick Falls—Lovejoy Chaplet Co., L. P. Brownell, Purch. Agt.—one automatic screw machine similar to B. & S. No. 0, for brass stock.

N. Y., New York—S. N. McGirr, Inc., 535 West 39th St.—36 in. lathe.

N. Y., North Tonawanda—Macbeth Body Co., F. W. Busl, Purch. Agt.—machinery for the manufacture of wood and steel bodies for heavy duty trucks.

N. Y., Utica—Shave Service Co., Inc., J. J. Crough, Ilion, Purch. Agt.—special machinery and equipment for the manufacture of light sheet metal novelties.

O., Columbus—Sun Mfg. Co., Lorain and McKinley Sts. (manufacturer of showcases, etc.), T. A. Morton, Genl. Mgr.—metal working machines, also one cutoff saw.

O., Lima—Ward Railway Equipment Co., J. T. Ward, Pres.—general foundry equipment for gray iron and semi-steel.

Pa., East Stroudsburg—Galvanized Products Co.—No. 60 Waterbury thread roller.

Pa., Hershey—Hershey Chocolate Co.—one steel bending machine for 8 ft. material ¼ in. thick.

Pa., Johnstown—Lorain Steel Co.—one 20 ton crane with 5 ton auxiliary.

Pa., Pittsburgh — L. C. Moore & Co., Oliver Bldg. (derricks)—monorail hoist.

Pa., Pittsburgh—United States Bureau of Mines, Forbes St.—10 ton electric traveling crane.

S. C., Greenville—Greenville Steel & Fdry. Co., Markley St., E. R. Saunders, Ch. Engr.—acetylene cutting and welding equipment, medium capacity combination punch and shear, air compressor (3 or 4 hammers), air riveting hammers, chippers, reamers, oil rivet forge, small friction saw, bolt machine, hoists, etc.

Tex., Corpus Christi—Pressed Metal Mfg. Co., W. Shelby, Pres.—machinery and tools for pressing metal, etc.

W. Va., Charleston—Metal Products Co., Boyd Bldg. (fabricated steel)—one combined punch and shear (used).

Wis., Milwaukee—F. Howend, 69 Wisconsin St.—one 3 ton electric traveling crane.

Wis., Milwaukee—A. H. Petersen Mfg. Co., 1614 Fratney St.—machine tools and machinery for factory for the manufacture of electrical specialties, to replace fire loss.

Wis., South Milwaukee—Ajax Pattern Co. (manufacturer of wood and metal patterns), J. M. Donohue, Purch. Agt.—wood turning machines and planer.

Wis., Watertown—Village Blacksmith Folks, Frederick St. (manufacturer of cutlery)—knife grinder and polishing machines for small addition to plant.

N. B., St. John—J. E. Wheaton, Blacks Beach (sawmill)—machinery for lath mill.

Ont., Chatham—R. Huff, 201 King St., West—general equipment for sheet metal works.

Ont., Stayner — W. Hullins — complete equipment for planing mill.

Ont., Waterloo—Globe Furniture Co., J. Bahnsen, Mgr.—complete equipment for foundry and machine shop.

Que., Montreal—H. Germain, 192 Bern St.—bench lathe, drill, air compressor, tank and small tools for garage.

Opportunities for Future Business

Calif., Los Angeles—The Art Furniture Co., 649 West Washington St., is having plans prepared for the construction of a 2 story, 55 x 150 ft. factory on 16th St. Private plans.

Calif., Los Angeles—The Pacific Readi-Cut Homes Co., 1330 South Hill St., is having plans prepared for the construction of a 2 story, 110 x 250 ft. factory. Private plans.

Calif., Los Angeles—The Paige Co. of Southern California, 2200 South Figueroa St., awarded the contract for the construction of a 3 story, 125 x 200 ft. garage and showrooms on 23rd and Figueroa Sts. Estimated cost $185,000.

Ill., Chicago—The Illinois Tool Wks., 154 East Erie St., is having plans prepared for the construction of a 1 story factory for the manufacture of high speed steel milling cutters, hobs and special tools, to contain 60,000 sq.ft. of floor space. Estimated cost $250,000. Puckey & Jenkins, 400 North Michigan Ave., Archts.

Ind., Muncie—The Amer. Lawn Mower Co., 18th and Monroe Sts., awarded the contract for the construction of a 1 story, 50 x 180 ft. factory. Estimated cost $26,000. Noted May 1.

Ia., Marshalltown—The C. A. Dunham Co., 230 East Ohio St., Chicago, Ill., manufacturer of steam heating specialties, will soon award the contract for the construction of a 2 story, 50 x 125 ft. addition to its plant, here. F. E. Schmidt, Factory Mgr.

Mass., Boston—The Edison Electric Illuminating Co., 70 State St., awarded the contract for the construction of a 5-story, 66 x 80 ft. substation, including machine rooms, on Cambridge St. Noted Apr. 17.

Mass., Peabody—The Dawson Bleachery awarded the contract for the construction of a 2 story, 52 x 153 ft. machine shop. Noted April 17.

Mass., Somerville—The International Harvester Co. of America, 43 Somerville Ave., is having plans prepared for the construction of a 1 story, 75 x 100 ft. service station. Private plans.

Mass., South Boston—The Gillette Safety Razor Co., 58 West 2nd St., had plans prepared for the construction of a 1 story addition to its plant. Estimated cost, including equipment, $30,000. Private plans.

Mass., Springfield—The Three Level Garage Co., c/o H. G. MacDougall, 39 Lincoln St., Boston, is having plans prepared for the construction of a 3 story garage, service and repair shop on Harrison and Chestnut Sts., here. Estimated cost $160,000. Private plans.

Mo., St. Louis—The Watlow Electric Mfg. Co., 1409 Pine St., awarded the contract for the construction of a 2 story, 38 x 40 ft. factory for the manufacture of electric heating appliances on Dickson St. Estimated cost $25,000.

Neb., Omaha—J. E. Lift, 6720 North 20th St., is having plans prepared for the construction of a 1 story, 66 x 120 ft. machine shop. Estimated cost $20,000. Private plans.

N. J., Camden—The Victor Talking Machine Co., Front and Cooper Sts., awarded the contract for the construction of a 10 story, 70 x 170 ft. plant.

N. Y., Buffalo—The Sterling Engine Co., 1250 Niagara St., plans to build an addition to its factory for the manufacture of gasoline engines. Cost will exceed $30,000.

N. Y., North Tonawanda—The Macbeth Body Co., Inc., plans to build a plant on Erie Ave. Cost will exceed $100,000. Address A. S. Loepere, 2157 Seneca St., Buffalo, N. Y.

N. Y., Penn Yan—The Whitfield Carriage Co. awarded the contract for the construction of a 50 x 200 ft. factory. Estimated cost $40,000.

O., Cleveland—The Bowler Fdry. Co., 1688 Columbus Rd., awarded the contract for the construction of a 1 story 90 x 203 ft. foundry, 40 x 100 ft. cleaning and shipping building, 25 x 42 ft. garage, 100 x 146 ft. pattern shop and office. Estimated cost $250,000. J. B. Bruce, Pres. Noted Apr. 17.

Pa., Phila.—J. C. Kooperman, 308 Florist Park, will build a 3 story, 56 x 84 ft. factory for the manufacture of copper kettles, tanks, etc., at 312-316 New St. Estimated cost $30,000. Noted Jan. 31.

Pa., St. Clair—The Philadelphia & Reading Ry., Reading Terminal, Philadelphia, awarded the contract for the construction of a 53 x 61 ft. machine shop, here.

Tex., Call—The Kirby Lumber Co., Commercial Natl. Bank Bldg., Houston, plans to build a sawmill, here. Estimated cost $75,000.

Tex., Corpus Christi—The Pressed Metal Mfg. Co. plans to build a 110 x 180 ft. plant for the manufacture of a patented milk bottle container. Estimated cost $150,000. W. Shelby, Pres.

Tex., Fort Worth—The Lone Star Tank Co., Wichita Falls, will build a 1 story repair shop for steel tank and freight cars on Saginaw Rd., here. Estimated cost $75,000. W. A. Stukey, Pres. Noted Mar. 27.

W. Va., Huntington—The Motor Car & Truck Co. plans to build a 3 story garage, service and repair station. Estimated cost $150,000.

W. Va., Westmoreland—The Huntington Sash & Cabinet Co., 19th St. and 2nd Ave., Huntington, plans to build a 1 story plant, here. Estimated cost $50,000.

Wis., Milwaukee—The A. H. Petersen Mfg. Co., 1614 Fratney St., plans to build a 1 story, 62 x 300 ft. factory for the manufacture of electrical specialties. Engineer or architect not selected.

Wis., North Milwaukee—The O. F. Kindt Mfg. Co., 986 47th St., Milwaukee, manufacturer of sash and doors, awarded the contract for the construction of a 2 story, 62 x 150 ft. factory, 1 story, 60 x 92 ft. warehouse and 32 x 40 ft. dry kiln, etc., on Cedarburg Rd., here. Estimated cost $75,000.

Wis., Wausau—The Marathon Electric Mfg. Co., Plumer Island, is receiving bids for the construction of a 1 story, 52 x 120 ft. addition to its factory. Estimated cost $40,000. A. Kimble, Mgr. Private plans.